# Alabama Reading and Mathematics Test 

## Item Specifications

for

## Mathematics

## Grade 8



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## NUMBER AND OPERATIONS

## Content Standard 1

Use various strategies and operations to solve problems involving real numbers.

## Item Type

Multiple-choice
Gridded

## Additional Information

Estimation may be required.
Word problems/real-life situations may be used.
Proportional reasoning may be required.
No computation problems will be used.
Any representation of a real number may be used.

## Sample Multiple-Choice Items

| 1. As the team's fundraisers, Agnes and Betty both sold candy bars. At the end of the fundraiser, Agnes determined that she sold 8 more candy bars than Betty sold. <br> If Agnes and Betty sold a total of 348 candy bars, how many did Betty sell? |  |  |  |
| :---: | :---: | :---: | :---: |
| 170 | 121 | 117 | 81 |
| A* | B | C | D |

2. Mrs. Salinas is making a test for her history class. There are these types of questions on the test: fill-in-the-blank, multiple-choice, and essay. So far, Mrs. Salinas has written 10 fill-in-the-blank, 21 multiple-choice, and 3 essay questions for the test.

Which of the following can be added to the test so that exactly $\frac{3}{5}$ of the test will be multiple-choice questions?

A 3 fill-in-the-blank and 2 essay questions
B 2 fill-in-the-blank, 3 multiplechoice, and 1 essay question*
C 4 multiple-choice and 3 essay questions
D 2 fill-in-the-blank, 1 multiplechoice, and 3 essay questions
3. Lizzy worked the following problem on the board.
$72.9 \times 12.6=91.85$
Her friend Marta immediately said Lizzy's answer was wrong.

What is one way Marta could have known Lizzy's answer was wrong?

A The answer should have 2 decimal places.
B The answer should have been less than 700.
C The answer should have no decimal places.
D The answer should have been greater than 720.*
$432 \quad 348 \quad 300 \quad 288$
A
B*
C
D
6. Diana has 4 quarts of water. She poured all the water into pint containers. Each pint container was filled to capacity. How many pint containers did she use?

| 2 | 8 | 16 | 40 |
| :---: | :---: | :---: | :---: |
| $\mathbf{A}$ | $\mathbf{B}^{*}$ | $\mathbf{C}$ | $\mathbf{D}$ |


7. Each student in Mr. Edward's class needs 3 sheets of graph paper for the math project. Each packet of graph paper holds 25 sheets. There are 28 students in his class. What is the least number of packets of graph paper he will need for his students?

| 2 | 3 | 4 | 5 |
| :---: | :---: | :---: | :---: |
| $\mathbf{A}$ | $\mathbf{B}$ | $\mathbf{C}^{*}$ | $\mathbf{D}$ |

## ARMT GRADE 8 MATHEMATICS

## Sample Gridded Items

1. Sydney played a video game 43 times last year. He did not lose more than 2 games in a row last year.

What is the greatest possible number of video games that Sydney could have lost last year?

Mark your answer in the answer grid.
2. Lydia, Sarah, and Denise collected campaign buttons. Lydia had 20 more buttons than Sarah. Denise had 3 times as many buttons as Sarah.

If the total number of campaign buttons the 3 girls had was 120 , how many buttons did Lydia have?

Mark your answer in the answer grid.
3. Larry has $\mathbf{6 6}$ music CDs. He has 2 times as many rock CDs as country CDs. He has 3 times as many rock CDs as hip-hop CDs.

How many rock CDs does Larry have?
4. A company that rents cars will rent a small car for $\$ 30$ per day. Another company will rent the same type of car for $\mathbf{\$ 2 0}$ per day plus $\mathbf{\$ 0 . 0 8}$ for each mile driven.

What is the number of miles at which the rental fees will be the same?

Mark your answer in the answer grid.
5. A group of $\mathbf{5}$ adults and $\mathbf{4}$ children went to the movies. The price for each movie ticket was a whole number dollar amount with tax included. Each adult ticket cost more than each child ticket. A total of $\$ 50$ was paid for the tickets.

What is the cost of a child's ticket?

Mark your answer in the answer grid.

Mark your answer in the answer grid.

# ARMT GRADE 8 MATHEMATICS 

## Answer Key

## Content Standard 1

## Sample Multiple-Choice

1. A
2. B
3. D
4. B
5. C
6. B
7. C

Sample Gridded

1. 29
2. 40
3. 36
4. 125
5. $\$ 5$

## NUMBER AND OPERATIONS

## Content Standard 2

Simplify expressions containing natural number exponents by applying one or more of the laws of exponents.

## Item Type

Multiple-choice

## Additional Information

Like and unlike bases may be used.
Word problems/real-life situations may be used.

## Sample Multiple-Choice Items


3. Which of the following is an equivalent way of expressing $2^{4} \cdot 2 \cdot \mathbf{2}^{2}$ ?
$2^{6}$
A $\quad B^{*}$

| $2^{8}$ | $2^{9}$ |
| :--- | :--- |
| $\mathbf{C}$ | $\mathbf{D}$ |

2. Which of the following is
3. Which of the following is equivalent to the expression below?

$$
\frac{2^{3} \cdot 5^{3} \cdot 5^{2}}{2 \cdot 5^{2}}
$$

A $2^{4} \cdot 5^{7}$
C $2^{2} \cdot 5^{5}$
B $2^{4} \cdot 5^{3}$
D $2^{2} \cdot 5^{3 *}$
5. Which of the following is equivalent to $3^{9}$ ?
A $3^{3} \cdot 3^{6 *}$
C $\frac{3^{18}}{3^{2}}$
B $3^{3} \cdot 3^{3}$
D $\frac{3^{6}}{3^{3}}$
6. Which of the following is equivalent to $4^{8} \div\left(4^{4} \div 4^{2}\right)$ ?

| $4^{6}$ | $4^{4}$ | 4 | $4^{0}$ |
| :---: | :---: | :---: | :---: |
| A* | B | C | D |

7. Which of the following is equivalent to $7^{4}$ ?
A $7^{5} \div 7^{4}$
C $7^{5} \div 7^{*}$
B $7^{4} \div 7$
D $7^{8} \div 7^{2}$
8. Natalie drew a square and marked the lengths of the sides using exponential notation. She then wrote the expression $5^{4} \times 5^{4}$ to represent the area of the square.

Which of the following is equivalent to the area, in square units, of Natalie's square?

| 5 | $5^{8}$ | $5^{16}$ | $5^{20}$ |
| :--- | :--- | :--- | :--- |
| $\mathbf{A}$ | $\mathbf{B}^{*}$ | $\mathbf{C}$ | $\mathbf{D}$ |

9. Which of the following is equivalent to $4^{16}$ ?
A $\frac{4^{12}}{4^{4}}$
C $4^{9} \cdot 4^{7} *$
B $\frac{4^{32}}{4^{2}}$
D $4^{4} \bullet 4^{4}$

## ARMT GRADE 8 MATHEMATICS

$$
\frac{4^{3} \cdot 4^{4} \cdot 4^{8}}{4^{5} \cdot 4}
$$

10. Which of the following is an equivalent expression?

| $4^{9}$ | $4^{20}$ | $12^{9}$ | $12^{20}$ |
| :---: | :---: | :---: | :---: |
| $\mathbf{A}^{*}$ | $\mathbf{B}$ | $\mathbf{C}$ | $\mathbf{D}$ |

12. Which of the following could be the length and width of a rectangular-shaped parking lot with an area of $4{ }^{10}$ square feet?

A $40^{5} \mathrm{ft}$ long by $40^{5} \mathrm{ft}$ wide
B $16^{4} \mathrm{ft}$ long by $16^{6} \mathrm{ft}$ wide
C $8^{5} \mathrm{ft}$ long by $8^{5} \mathrm{ft}$ wide
D $4^{4} \mathrm{ft}$ long by $4^{6} \mathrm{ft}$ wide*
11. Which of the following is equivalent to

$$
\frac{7^{2} \cdot 7^{6} \cdot 7^{2}}{7 \bullet 7} \boldsymbol{?}
$$

13. Which of the following could be the dimensions of a rectangular prism-shaped fish tank with a volume of $3^{6}$ cubic feet?

A $3^{6}$ by $3^{6}$ by $3^{6}$
B $3^{3}$ by $3^{3}$ by $3^{3}$
C $3^{3}$ by $3^{2}$ by $3^{*}$
D $3^{2}$ by $3^{2}$ by 3

## ARMT GRADE 8 MATHEMATICS

## Answer Key

## Content Standard 2

## Sample Multiple-Choice

1. C
2. B
3. B
4. D
5. A
6. A
7. C
8. B
9. C
10. A
11. A
12. D
13. C

## NUMBER AND OPERATIONS

## Content Standard 3

Use order of operations to evaluate and simplify algebraic expressions.

## Item Type

Multiple-choice
Gridded

## Additional Information

Substitution may be required.
Raising a number to a power may be required.
Word problems may be used.

## Sample Multiple-Choice Items

1. Which is equivalent to the expression below?

$$
4(12 m \div 3)+9-2(3 m)
$$

A $16 m+9$
C 10m+9*
B $31 m$
D $19 m$
2. If the denominator is not zero, which expression is equivalent to $\frac{6 m^{2} n}{24 m n}$ ?
$\frac{m}{4}$
$\frac{m^{3} n^{2}}{4}$
$\frac{m^{3}}{4}$
$\frac{1}{4}$
A*
B
C
D
3. Each side of a square measures $(3 k+5)$ units, and its perimeter can be expressed as $4(3 k+5)$ units.

Which of the following is another way of expressing this perimeter?
A $3 k+9$
C $12 k+5$
B $12 k+20^{*}$
D $7 k+9$
4. Which expression below is equivalent to
$4 y-2 y(y)+10 y \div 2 y ?$

A $y+5 y$
B $2 y^{2}+5 y$
C $-2 y+3 y+12$
D $-2 y^{2}+4 y+5^{*}$
5. Which of the following is equivalent to the expression
$14+7(4 r)-20 ?$
A $3 r-35$
C $11 r+6$
B $4 r+1$
D $28 r-6^{*}$
6. Which of these is equivalent to the expression
$4 \cdot 3 b-6 \cdot 4 b ?$

| $-12 b$ | $-3 b$ | $6 b$ | $2 b$ |
| :---: | :---: | :---: | :---: |
| $\mathbf{A}^{*}$ | $\mathbf{B}$ | $\mathbf{C}$ | $\mathbf{D}$ |

7. What is the value of the expression below if $x=4$, $p=9$, and $q=12$ ?

$$
\frac{x^{4}+8}{2 p+q}-5
$$

| .95 | 3.8 | 4.1 | 7.4 |
| :---: | :---: | :---: | :---: |
| $\mathbf{A}$ | $\mathbf{B}^{*}$ | C | D |

## ARMT GRADE 8 MATHEMATICS

## Sample Gridded Items

1. If $x=5, y=2$, and $z=3$, what is the value of the expression below?

$$
2(x+y)-\frac{2 z}{5}+3 x^{2}
$$

3. If $p=3$ and $q=2$, what is the value of the expression below?

$$
(p+q)^{3}
$$

Mark your answer in the answer grid.
4. If $k=5$ and $m=16$, what is the value of the expression below?
$k^{3}+\left[(m \div 4)+3^{2} \cdot 20\right]$

Mark your answer in the answer grid.

Mark your answer in the answer grid.

## ARMT GRADE 8 MATHEMATICS

## Answer Key

## Content Standard 3

## Sample Multiple-Choice

1. C
2. A
3. B
4. D
5. D
6. A
7. B

Sample Gridded
1.87.8 OR $\frac{439}{5}$ OR $87 \frac{4}{5}$
2. 53
3. 125
4. 309

1. The table below contains coordinates of points on the graph of a line.

| $\boldsymbol{x}$ | $\boldsymbol{y}$ |
| :---: | :---: |
| 4 | 5 |
| 2 | 1 |
| 0 | -3 |
| -2 | -7 |

## Which graph best represents this line?





B


D
2. Which graph best represents the equation of the line that has a $y$-intercept of ${ }^{-1}$ and a slope of $\frac{1}{3}$ ?


A


B


C


D*
3. Which graph best represents a line with a slope of $-\frac{2}{3}$ and a $y$-intercept of ${ }^{-1}$ ?


A


B*
C

D
4. Which graph best represents a line with an $x$-intercept of 4 and a $y$-intercept of 5 ?




B


D

## ARMT GRADE 8 MATHEMATICS

5. Which graph best represents a line with a slope of $\frac{5}{2}$ ?


A


B*


C


D
6. Which graph best shows a slope of $-\frac{4}{3}$ and a $y$-intercept of 2?

7. Which of the following best represents the graph of a line that contains the point $\left(4,{ }^{-} 6\right)$ and has a slope of $\frac{3}{4}$ ?


A


B


C


D*

## ARMT GRADE 8 MATHEMATICS

8. Which equation represents the line below?

A $y=-\frac{2}{3} x+3$ *
B $y=2 x-6$
C $y={ }^{-} x+4$
D $y=\frac{1}{2} x-3$
9. Which graph best represents the linear function $4 x-3 y=12$ ?


A


B*


C


D

## ARMT GRADE 8 MATHEMATICS

## Sample Open-Ended Items

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.

1. Construct a coordinate plane and label the axes. Plot the points $M(4,3)$, $N(0,5)$, and $K(-2,6)$ on the coordinate plane. Draw a line through the points.
a. What are the slope and $y$-intercept of the line?
b. Write the equation of the line in slope-intercept form.

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

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.
2. Wilson is making chocolate milk by adding chocolate syrup to white milk. The table below shows the amount of chocolate syrup needed for the amount of white milk.

Chocolate Milk

| Chocolate Syrup <br> (in teaspoons) | White Milk <br> (in cups) |
| :---: | :---: |
| 6 | 2 |
| 9 | 3 |
| 12 | 4 |

a. Create a coordinate plane and label the axes. Graph the data shown in the table as a line.
b. What is the slope of the line?

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

## ARMT GRADE 8 MATHEMATICS

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.
3. Jenalysa was asked to graph the equation $3 x+y=-4$.
a. Create a table with 4 ordered pairs that are on the line of the equation.
b. Create a coordinate plane and label the axes. Graph the equation $3 x+y=-4$ using the ordered pairs from the table.
c. What are the slope and $y$-intercept of the line?

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

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.
4. Ashlynn was asked to graph the equation $4 x+5 y=\mathbf{- 2 0}$.
a. What are the slope and $y$-intercept of the equation?
b. Create a coordinate plane and label the axes. Draw the line of the equation $4 x+5 y=-20$ using the slope and $y$-intercept.

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

## ARMT GRADE 8 MATHEMATICS

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.
5. Malcolm wants to graph the equation $y=x-6$.
a. What are the slope and $y$-intercept of Malcolm's equation?
b. Create a coordinate plane and label the axes. Draw the line of the equation $y=x-6$ using the slope and $y$-intercept.

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

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.
6. Kenneth does not know how to graph the equation $4 x-3 y=9$. Your teacher asked you to help Kenneth.
a. Create a coordinate plane and label the axes. Graph the equation $4 x-3 y=9$.
b. Provide a set of instructions for Kenneth so that he will be able to graph this line or any other line in the future.

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

## ARMT GRADE 8 MATHEMATICS

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.
7. Create a coordinate plane and label the axes. Plot the points $X(\mathbf{-}, \mathbf{-} \mathbf{-})$ and $\boldsymbol{Y}(4,-5)$. Draw a line through the points, creating $\overleftrightarrow{X Y}$.
a. What is the slope of $\overleftrightarrow{X Y}$ ?
b. Draw a line parallel to $\overleftrightarrow{X Y}$ passing through $(0,2)$ on your coordinate plane.
c. Mathematically, explain why these two lines on your coordinate plane are parallel.

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

## ARMT GRADE 8 MATHEMATICS

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.
8. The cafeteria sells packages of pretzels for the cost shown in the table below.

Cost of Pretzels

| Number of <br> Packages of <br> Pretzels | Cost |
| :---: | :---: |
| 2 | $\$ 0.50$ |
| 4 | $\$ 1.00$ |
| 6 | $\$ 1.50$ |

a. Create a coordinate plane and label the axes. Graph the data shown in the table as a line.
b. What is the slope of the line?

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

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.
9. Abby wants to graph the equation $y+4=3 x$.
a. What are the slope and $y$-intercept of the equation?
b. Create a coordinate plane and label the axes. Draw the line of the equation $y+4=3 x$ using the slope and $y$-intercept.

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

# ARMT GRADE 8 MATHEMATICS 

## Answer Key

## Content Standard 4

## Sample Multiple-Choice

1. A
2. D
3. $B$
4. C
5. B
6. A
7. D
8. A
9. B

## ALGEBRA

## Content Standard 5

## Solve problems involving linear functions.

## Item Type

Multiple-choice
Gridded

## Additional Information

Equations may be expressed in terms of $f(x)$.
Determining the value of a variable in a linear equation given the values of other variables in the linear equation may be required.
A special relationship between lines on a coordinate plane may be required (same line, intersecting lines, parallel lines, and perpendicular lines).
Word problems/real-life situations may be used.
Determining the equation of a line given two ordered pairs or set of points may be required.
Determining the equation of a line given the line graphed on the coordinate plane may be required.
The options may be four equations.

## Sample Multiple-Choice Items

| $\boldsymbol{x}$ | $\boldsymbol{y}$ |
| :---: | :---: |
| -2 | -5 |
| -1 | -3 |
| 0 | -1 |
| 2 | 3 |

2. What is the range of the function $f(x)=\frac{1}{2} x+3$ when the domain is $\{\mathbf{3}, \mathbf{1}, 2\}$ ?
A $\left\{4 \frac{1}{2}, 2 \frac{1}{2}, 4\right\}$
C $\left\{2 \frac{1}{2}, 4,3 \frac{1}{2}\right\}$ values of $x$ and $y$ shown in the table above?
A $y={ }^{-} x+3$
C $y=3+x$
B $y=2 x-1^{*}$
D $y=-4 x+6$
3. Which ordered pair is a solution for the equation

$$
y=\frac{2}{3} x-1 ?
$$

$(-3,1)$
$(0,1)$
$(3,1)$
$(6,2)$
A
B
C*
D
4. If $(-2, y)$ is a solution to the equation $4 x+7 y=20$, what is the value of $y$ ?
$1 \frac{1}{2}$
4
7
A
B
C*
D
5. Which function has the ordered pair $(2,-5)$ as a solution?
A $y=4 x+3$
C $y=3 x-8$
B $y=-4 x+3 *$
D $y=4 x-10$

6. Which equation best represents the line graphed on the coordinate plane?
A $y=-4 x-\frac{1}{2}$
C $y=\frac{1}{4} x-\frac{1}{2}$ *
B $y=-2 x+4$
D $y=\frac{1}{2} x+4$
7. Point $(3,5)$ is a point on the linear equation $y=4 x+b$.

What is the value of $\boldsymbol{b}$ ?
$-17$
17
23
A
B*
C
D
8. If $(x, 5)$ is a solution to the equation $3 x+5 y=-5$, what is the value of $x$ ?

| ${ }^{-10}$ | -4 | 2 | $6 \frac{2}{3}$ |
| :---: | :---: | :---: | :---: |
| $\mathbf{A}^{*}$ | B | C | D |

9. Which equation is best represented by the linear function graphed below?

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

## ARMT GRADE 8 MATHEMATICS

$$
\begin{aligned}
& y=-2 x+4 \\
& y=\frac{1}{2} x+4
\end{aligned}
$$

10. Which statement describes the relationship between the graphs of the lines above?

A The line graphs are the same line.
B The line graphs are parallel lines.
C The line graphs are perpendicular lines.*

D The line graphs intersect, but are not perpendicular.
11. The graph below represents

$$
y=\frac{2}{3} x-4
$$



If the $y$-intercept shown is increased by 3 , which equation represents the translation?
A $y=\frac{2}{3} x$
C $y=\frac{2}{3} x+3$
B $y=\frac{2}{3} x-7$
D $y=\frac{2}{3} x-1$ *

## ARMT GRADE 8 MATHEMATICS

## Sample Gridded Items

1. Vivian is driving from Alabama to Georgia. She is driving at a constant speed on the highway. The table below shows her distance from the Alabama state line.

Distance by Time

| Time of <br> Day | Distance from <br> Alabama State Line <br> (in miles) |
| :---: | :---: |
| 1:00 P.M. | 20 |
| 1:04 P.M. | 15 |

How many minutes after 1:00 P.M. will it be when Vivian drives across the Alabama state line?

Mark your answer in the answer grid.
2. Cassidy's pickup truck decreased in value at a constant rate at the start of each successive year. The pickup truck was worth $\$ 16,500.00$ in 1996 and $\$ 10,100.00$ in 1998 . When the pickup truck was worth $\$ 500.00$, Cassidy sold it.

What year did Cassidy sell the pickup truck?

Mark your answer in the answer grid.

## ARMT GRADE 8 MATHEMATICS

## Answer Key

## Content Standard 5

## Sample Multiple-Choice

1. B
2. D
3. C
4. C
5. B
6. C
7. $B$
8. $A$
9. $\mathbf{A}$
10. C
11. D

## Sample Gridded

1. 16
2. 2001

## ARMT GRADE 8 MATHEMATICS

## ALGEBRA

## Content Standard 6

Solve multi-step linear equations, including equations requiring the use of the distributive property.

## Item Type

Multiple-choice
Gridded

## Additional Information

Coefficients may be simple fractions or decimals.
Operation using fractions may be required.
One or two sets of parentheses may be used.
Adding or subtracting a variable to or from both sides of the equation may be required. The solution to the equation may be a fraction or a decimal.

## Sample Multiple-Choice Items


3. What is the value of $s$ in the equation below?

$$
0.3 s+0.8(s-12)=33.3
$$

| 4.29 | 34 | 39 | 41.2 |
| :---: | :---: | :---: | :---: |
| $\mathbf{A}$ | $\mathbf{B}$ | C $^{*}$ | D |

4. In the equation below, what is the value of $\boldsymbol{m}$ when $k=9$ ?

$$
\frac{2}{3} k=4 m-18
$$

$5 \frac{1}{4}$
6
$6 \frac{3}{4}$
9
A
B*
C
D
5. What is the value of $q$ that makes the equation true?

$$
3(q+4)-10 q=2 q+3
$$

A 1*
C No solution
B 2
D All real numbers
6. What is the value of $g$ if $h=5$ ?

$$
6 g-1=-5 h
$$

| 1.5 | 2 | ${ }^{-} 4$ | ${ }^{-} 5.8$ |
| :---: | :---: | :---: | :---: |
| $\mathbf{A}$ | B | $\mathbf{C}^{*}$ | D |

7. What is the value of $t$ that makes the equation true?

$$
\frac{13-t}{4}+2.5=11
$$

| 4.5 | 28.5 | -8.5 | -21 |
| :--- | :--- | :--- | :--- |

A
B
C
D*
8. If $\frac{3}{4}(k-5)=15$, what is the value of $k$ ?

| 65 | 25 | 12 | 10 |
| :--- | :--- | :--- | :--- |
| A | $\mathbf{B}^{*}$ | C | D |



## ARMT GRADE 8 MATHEMATICS

## Sample Gridded Items

1. What is the value of $m$ in the equation below?

$$
2 m-3=-m+6
$$

Mark your answer in the answer grid.
4. What is the value of $k$ in the equation below?

$$
\frac{k-7}{3}=2.4
$$

Mark your answer in the answer grid.
2. What is the value of $m$ in the equation below?
5. What is the value of $k$ in the equation below?

$$
6(k-2)=\frac{1}{3}(9+3 k)
$$

Mark your answer in the answer grid.
3. What is the value of $g$ in the equation below?

$$
9(g)-13=\frac{115}{5}
$$

Mark your answer in the answer grid.

## ARMT GRADE 8 MATHEMATICS

6. What value of $t$ makes the
7. What value of $y$ makes the equation below true?

$$
7 y=4(y+33)
$$

Mark your answer in the answer grid.
Mark your answer in the answer grid.
7. What is the value of $d$ in the equation $5 d=8 d-36$ ?
9. What value of $\boldsymbol{h}$ makes the

Mark your answer in the answer grid.
equation below true?

$$
78-h=5 h
$$

Mark your answer in the answer grid.

## ARMT GRADE 8 MATHEMATICS

## Answer Key

## Content Standard 6

## Sample Multiple-Choice

1. B
2. A
3. C
4. B
5. A
6. C
7. D
8. B
9. D

## Sample Gridded

1. 3
2.1
2. 4
3. 14.2 OR $\frac{142}{10}$ OR $14 \frac{2}{10}$ OR $14 \frac{1}{5}$
5.3
4. 12
7.12
5. 44
9.13

## GEOMETRY

## Content Standard 7

## Solve problems using the Pythagorean Theorem.

## Item Type

Multiple-choice
Gridded
Open-ended

## Additional Information

Word problems/real-life situations may be used.
Diagrams may be included.
Determining the missing leg or hypotenuse of a right triangle may be required.
Determining if a figure is a right triangle may be required.
No radical will be included.
Extracting a perfect square root may be required.
All square roots must be perfect squares no greater than the square root of 225 .

## Sample Multiple-Choice Items


2. Jeb built a ramp like the one pictured below.


What is the height, in inches, of Jeb's ramp?

| 6 | 12 | 18 | 36 |
| :---: | :---: | :---: | :---: |
| $\mathbf{A}^{*}$ | $\mathbf{B}$ | $\mathbf{C}$ | $\mathbf{D}$ |

3. Lookout Road is perpendicular to Village Road. Sam knows that the straight-line distance from his house to Julie's house is $\mathbf{1 5}$ miles. Julie knows that the straight-line distance from her house to the library is 12 miles. Sam used the Pythagorean Theorem to estimate the distance from his house to the library.


What is the distance from Sam's house to the library?

3 miles
A

$$
9 \text { miles }
$$

B*
12 miles
C
27 miles
D
4. Trapezoid $J K L M$ is shown below.


If the length of the altitude in the trapezoid is $\mathbf{8}$ centimeters, what is the length of leg $\overline{K L}$ ?
12 cm
10 cm
9 cm
6 cm
A
B*
C
D
5. A right triangle has a hypotenuse measuring 15 inches and one leg measuring 9 inches. What is the length, in inches, of the other leg of the triangle?
$3 \quad 6$
10
12
A
B
C
D*
6. Cameron walked 8 blocks due east and then 6 blocks due north. What is the shortest distance in blocks from the point where Cameron started to where she ended?

| A | B | 10 | 14 |
| :--- | :--- | :--- | :--- |
| C* | D |  |  |

## Sample Gridded Items

1. The dimensions of a trapezoid are shown in the diagram below.


What is the length, in feet, of $\boldsymbol{k}$ ?

Mark your answer in the answer grid.
4. From the front door of his house, Darren walked 9 yards due east and 12 yards due south. What is the shortest distance in yards from Darren's starting point to where he stopped?

Mark your answer in the answer grid.
2. The dimensions of a trapezoidshaped flag are shown below.


What is the length, in centimeters, of $\boldsymbol{h}$ ?

Mark your answer in the answer grid.

## Sample Open-Ended Items

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.

1. Reid, Dario, and Ruben each have 3 pieces of craft sticks. The chart below shows the lengths of each of their pieces of craft sticks.

Lengths of Craft Sticks, (in centimeters)

|  | Piece 1 | Piece 2 | Piece 3 |
| :--- | :---: | :---: | :---: |
| Reid | 12 | 9 | 10 |
| Dario | 13 | 12 | 5 |
| Ruben | 5 | 3 | 4 |

Each boy wants to use his 3 pieces of craft sticks to form a right triangle. The pieces of craft sticks cannot be bent, broken, cut, or overlapped. The pieces of craft sticks must be placed so that only the ends of the pieces of craft sticks are touching.

Which boy or boys can use their pieces of craft sticks to form a right triangle?

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

## ARMT GRADE 8 MATHEMATICS

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.
2. Devon designed a sign for his company. The sign is in the shape of a right triangle. One leg of the triangle is $\mathbf{4}$ feet. The other leg is $\mathbf{3}$ feet long.
a. What is the length, in feet, of the hypotenuse of the sign?
b. Make a sketch of the shape of the sign. Label the measurements of the legs and hypotenuse of the sign.

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

## ARMT GRADE 8 MATHEMATICS

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.
3. Which of the two triangles shown below has the greater area? How many square units is the greater triangle?

$$
\text { Triangle } Y
$$

Triangle $X$


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

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.
4. Mrs. Hinojosa wants to find the length of the diagonal of the rectangular floor of her classroom that measures 9 meters by 12 meters.
a. Draw and label a picture of Mrs. Hinojosa's classroom floor.
b. Calculate the diagonal length of the classroom floor.

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

## ARMT GRADE 8 MATHEMATICS

## Answer Key

## Content Standard 7

## Sample Multiple-Choice

1. D
2. A
3. B
4. B
5. D
6. C

## Sample Gridded

1. 5
2. 12
3. 13
4. 15

## Sample Open-Ended

## 1. Sample Response(s):

Dario and Ruben can form right triangles.
Reid cannot form a right triangle because: $9^{2}+10^{2} \neq 12^{2},(81+100 \neq 144)$
Dario can form a right triangle because: $12^{2}+5^{2}=13^{2},(144+25=169)$
Ruben can form a right triangle because: $3^{2}+4^{2}=5^{2},(9+16=25)$

| Score Point | Response Attributes |
| :---: | :--- |
| $\mathbf{3}$ | All are correct. |
| $\mathbf{2}$ | The logic or explanation is correct. <br> The logic or explanation is correct, and there is an error in the <br> calculation or drawing. |
| $\mathbf{1}$ | One or more answers to problems or drawings are correct. <br> Partial logic is correct. OR |
| $\mathbf{0}$ | None is correct (Also, blanks, rewrites problem, foreign language, <br> illegible, refusals, off-task, etc., scored as invalid.) |

## ARMT GRADE 8 MATHEMATICS

## GEOMETRY

## Content Standard 8

Compare quadrilaterals, triangles, and solids using their properties and characteristics.

## Item Type

Multiple-choice

## Additional Information

Identifying the properties and characteristics of all types of quadrilaterals will be required. Identifying the properties and characteristics of all types of triangles will be required. Identifying the properties and characteristics of all types of solids will be required. Identifying the relationships between types of quadrilaterals, triangles, and solids will be required.

## Sample Multiple-Choice Items

1. Which of the following statements about quadrilaterals is always true?

A All parallelograms are similar.
B All squares are rhombuses.*
C All rectangles are congruent.
D All trapezoids are parallelograms.
2. Which of the following could not be a quadrilateral with 4 congruent sides?

A Rhombus
B Trapezoid*
C Rectangle
D Parallelogram

## ARMT GRADE 8 MATHEMATICS

3. Which figure below does not have at least 1 rectangular face?

A Triangular pyramid*
B Triangular prism
C Square pyramid
D Pentagonal prism
4. If the base angles of two isosceles triangles are congruent, which statement is always true?

A The triangles are right triangles.
B The triangles are congruent.
C The triangles are equilateral.
D The triangles are similar.*
5. Which statement is always true about any two equilateral triangles?

A Corresponding angles are congruent.*
B Corresponding sides are congruent.
C The triangles are scalene.
D The triangles are obtuse.
6. Which of these statements is always true for both a rhombus and a square?

A All 4 sides are congruent.*
B All 4 angles are congruent.
C The diagonals are congruent.
D No angles are congruent.
7. Which of these statements about triangles is not true?

A An isosceles triangle can also be a right triangle.
B An acute triangle can also be an equilateral triangle.
C A right triangle can also be an obtuse triangle.*
D An obtuse triangle can also be an isosceles triangle.
8. The measure of the side of rhombus GHIJ is equal to the measure of the side of square RSTU. Which statement about the two quadrilaterals must be true?

A Their angle measures are equal.
B Their diagonal measures are equal.
C Their areas are equal in measure.
D Their perimeters are equal.*

# ARMT GRADE 8 MATHEMATICS 

## Answer Key

## Content Standard 8

## Sample Multiple-Choice

1. B
2. B
3. A
4. D
5. A
6. A
7. C
8. D

## ARMT GRADE 8 MATHEMATICS

## MEASUREMENT

## Content Standard 9

Determine the measures of special angle pairs, including adjacent, vertical, supplementary, and complementary angles, and angles formed by parallel lines cut by a transversal.

## Item Type

Multiple-choice
Gridded

## Additional Information

Diagrams may be included.
Knowledge of the sum of angles may be required.
Determining measurements of angles when the measurements of angles are expressed as algebraic expressions may be required.

## Sample Multiple-Choice Items

1. In the figure below, $\overleftrightarrow{K M}$ and $\overleftrightarrow{P Q}$ intersect at $Y$ as shown.


What is the measure of $\angle K Y Q$ ?

| $280^{\circ}$ | $145^{\circ}$ | $140^{\circ}$ | $72.5^{\circ}$ |
| :---: | :---: | :---: | :---: |
| $\mathbf{A}$ | $\mathbf{B}$ | $\mathbf{C}^{*}$ | D |

## ARMT GRADE 8 MATHEMATICS

2. In the figure below, $\overline{M N} \| \overline{K L}$ and are intersected by transversals $\overline{M L}$ and $\overline{K N}$.


What is the measure of $\angle X M N$ ?
$130^{\circ}$
A
$85^{\circ}$
B
$55^{\circ}$
$50^{\circ}$
C
D*

## ARMT GRADE 8 MATHEMATICS

3. In the figure below, $\overleftrightarrow{X Y} \| \overleftrightarrow{J K}$ and are cut by transversals $\overleftrightarrow{X Z}$ and $\overline{Y J}$ to form the angles shown.


If $\angle X Y J=46^{\circ}$ and $\angle K J Z=75^{\circ}$, what is the measure of $\angle Z J Y$ ?

| $134^{\circ}$ | $121^{\circ}$ | $75^{\circ}$ | $46^{\circ}$ |
| :---: | :---: | :---: | :---: |
| $\mathbf{A}$ | $\mathbf{B}^{*}$ | C | D |

4. In the figure below, $\overrightarrow{V X} \perp \overrightarrow{V Z}$, and $\angle W V Z=150^{\circ}$.


What is the measure of $\angle W V X$ ?

| $30^{\circ}$ | $45^{\circ}$ | $60^{\circ}$ | $90^{\circ}$ |
| :---: | :---: | :---: | :---: |
| $\mathbf{A}$ | $\mathbf{B}$ | $\mathbf{C}^{*}$ | $\mathbf{D}$ |

5. In the figure below, $\overline{Q P} \perp \overleftrightarrow{M P}$ and $\triangle N Q S$ is an equilateral triangle with base $\overline{N S}$ as shown.


If $m \angle N Q P=30^{\circ}$, what is the measure of $\angle M N Q$ ?

| $60^{\circ}$ | $90^{\circ}$ | $120^{\circ}$ | $150^{\circ}$ |
| :---: | :---: | :---: | :---: |
| $\mathbf{A}$ | $\mathbf{B}$ | $\mathbf{C}^{*}$ | $\mathbf{D}$ |

6. In the figure below, lines $g$ and $h$ are parallel and are cut by transversal $\boldsymbol{j}$ to form the angles shown.


If the measure of $\angle 8$ is $116^{\circ}$, what is the measure of $\angle 4$ ?

| $180^{\circ}$ | $116^{\circ}$ | $64^{\circ}$ | $26^{\circ}$ |
| :---: | :---: | :---: | :---: |
| $\mathbf{A}$ | $\mathbf{B}^{*}$ | $\mathbf{C}$ | $\mathbf{D}$ |

## ARMT GRADE 8 MATHEMATICS

7. In the figure below, $\overrightarrow{F K} \perp \overrightarrow{F J}$, and points $E, F$, and $G$ lie on the same line.


If $m \angle 8=32^{\circ}$ and $m \angle 8=m \angle 6$, what is the $m \angle 9 ?$

| $26^{\circ}$ | $58^{\circ}$ | $122^{\circ}$ | $148^{\circ}$ |
| :---: | :---: | :---: | :---: |
| $\mathbf{A}^{*}$ | $\mathbf{B}$ | C | D |

8. In the figure below, $\overleftrightarrow{S T} \| \overleftrightarrow{Q G}$ and are intersected by transversals $\overline{T Q}$ and $\overline{T G}$ as shown.


What is the measure of $\angle T Q H$ ?
$37^{\circ}$
$53^{\circ}$
$127^{\circ}$
$143^{\circ}$
A
B
C*
D

## ARMT GRADE 8 MATHEMATICS

9. In the figure below, lines $\boldsymbol{m}$ and $\boldsymbol{n}$ are parallel and are cut by transversal $\boldsymbol{k}$ to form the angles shown.


If the measure of $\angle 8$ is $28^{\circ}$, what is the measure of $\angle 5$ ?

| $152^{\circ}$ | $118^{\circ}$ | $62^{\circ}$ | $56^{\circ}$ |
| :---: | :---: | :---: | :---: |
| $\mathbf{A}^{*}$ | $\mathbf{B}$ | $\mathbf{C}$ | $\mathbf{D}$ |

10. In the figure below, $\angle W Y Z$ and $\angle Z Y X$ are complementary.


If the measure of $\angle W Y Z=27^{\circ}$, what is the measure of $\angle Z Y X$ ?

| $153^{\circ}$ | $73^{\circ}$ | $63^{\circ}$ | $27^{\circ}$ |
| :---: | :---: | :---: | :---: |
| $\mathbf{A}$ | $\mathbf{B}$ | $\mathbf{C}^{*}$ | $\mathbf{D}$ |

## ARMT GRADE 8 MATHEMATICS

11. In the figure below, $\overleftrightarrow{F J}$ and $\overleftrightarrow{G I}$ intersect at $H$ to form the angles shown.


What is the measure of $\angle F H I$ ?

| $45^{\circ}$ | $90^{\circ}$ | $135^{\circ}$ | $180^{\circ}$ |
| :---: | :---: | :---: | :---: |
| $\mathbf{A}$ | $\mathbf{B}$ | $\mathbf{C}^{*}$ | $\mathbf{D}$ |

12. In the figure below, $\overline{X Y} \| \overline{W Z}$ and are cut by transversals $\overleftrightarrow{X V}$ and $\overline{Y W}$.


What is the measure of $\angle V W Z$ ?

| $90^{\circ}$ | $52^{\circ}$ | $38^{\circ}$ | $14^{\circ}$ |
| :---: | :---: | :---: | :---: |
| $\mathbf{A}$ | $\mathbf{B}^{*}$ | C | D |

## ARMT GRADE 8 MATHEMATICS

13. In the figure below, line $\boldsymbol{h}$ intersects line $\boldsymbol{j}$ to form the angles shown.


If the measure of $\angle 2=108^{\circ}$, what is the measure of $\angle 3$ ?

| $180^{\circ}$ | $108^{\circ}$ | $82^{\circ}$ | $72^{\circ}$ |
| :---: | :---: | :---: | :---: |
| $\mathbf{A}$ | $\mathbf{B}$ | $\mathbf{C}$ | $\mathbf{D}^{*}$ |

14. In the figure below, $\angle K L M$ and $\angle M L P$ are supplementary.


If the measure of $\angle M L P=22^{\circ}$, what is the measure of $\angle K L M$ ?

| $158^{\circ}$ | $78^{\circ}$ | $44^{\circ}$ | $22^{\circ}$ |
| :---: | :---: | :---: | :---: |
| $\mathbf{A}^{*}$ | B | C | D |

## ARMT GRADE 8 MATHEMATICS

15. In the figure below, $\overleftrightarrow{E H} \perp \overrightarrow{G J}$ and $\overleftrightarrow{F I}$ intersects $\overleftrightarrow{E H}$ at $G$ as shown below.


What is the measure of $\angle J G I$ ?

| $105^{\circ}$ | $90^{\circ}$ | $75^{\circ}$ | $15^{\circ}$ |
| :---: | :---: | :---: | :---: |
| $\mathbf{A}$ | $\mathbf{B}$ | $\mathbf{C}$ | $\mathbf{D}^{*}$ |

## ARMT GRADE 8 MATHEMATICS

## Sample Gridded Items

1. 



In this figure, lines $\boldsymbol{j}, \boldsymbol{k}$, and $\boldsymbol{m}$ intersect and form the angles as shown.
If $\angle 3=40^{\circ}$ and $\angle 5=35^{\circ}$, what is the measure of $\angle 4$ ?

Mark your answer in the answer grid.
2. In the figure below, lines $l, m$, and $k$ intersect as shown.


What is the value, in degrees, of $x$ in the diagram above?

Mark your answer in the answer grid.
3. In the figure shown below, two lines intersect to form the angles shown, and the measures of $\angle 1, \angle 2$, and $\angle 3$ add up to $323^{\circ}$.


What is the measure, in degrees, of $\angle 1$ ?

Mark your answer in the answer grid.
4. In the figure below, lines $\boldsymbol{s}$ and $\boldsymbol{t}$ are parallel and are cut by transversal $\boldsymbol{w}$ to form the angles shown.


If the measure of $\angle 5=43^{\circ}$, what is the measure, in degrees, of $\angle 8$ ?

Mark your answer in the answer grid.
5. In the figure below, lines $\boldsymbol{j}, \boldsymbol{k}$, and $m$ intersect and form the angles shown.


If $m \angle 5=28^{\circ}$ and $\angle 8$ and $\angle 9$ are complementary, what is the measure, in degrees, of $\angle 9$ ?

Mark your answer in the answer grid.

## ARMT GRADE 8 MATHEMATICS

## Answer Key

## Content Standard 9

## Sample Multiple-Choice

1. C
2. D
3. B
4. $C$
5. C
6. B
7. $\mathbf{A}$
8. C
9. A
10. C
11. C
12. B
13. D
14. A
15. D

Sample Gridded

1. 105
2. 65
3. 143
4. 137
5. 62

## ARMT GRADE 8 MATHEMATICS

## MEASUREMENT

## Content Standard 10

Find the perimeter and area of regular and irregular plane figures.

## Item Type

Multiple-choice
Gridded

## Additional Information

Determining the area of a figure when given the perimeter of the figure may be required.
Word problems may be used.
Drawings may be used.
Determining the area of a part of a circle may be required.
Options may be left in terms of $\pi$.
Unnecessary dimensions may be given.
Inscribed figures may be used.

## Sample Multiple-Choice Items

1. What is the area of the figure below in square centimeters?


38 sq cm
A
80 sq cm
B

92 sq cm
C*

104 sq cm
D
2. A design is drawn on a $5 \times 8$ rectangular grid, as shown below.


Which of the following is closest to the area of the shaded design?

22
28
B*
C
D
3. The radius of a certain wheel is 7 inches.

Which of the following is closest to the circumference of the wheel?
A 10.99 inches
C 21.98 inches
B 14.21 inches
D 43.96 inches*
4. What is the perimeter, in feet, of the parallelogram below?

142.82
A
70.6
B
53.4
43.9
B
C*
D
5. Points $K, L$, and $M$ all lie on circle $R$.


The radius of circle $R$ is 4 centimeters. What is the area, in square centimeters, of the shaded region of the circle?

## ARMT GRADE 8 MATHEMATICS

## Sample Gridded Items

1. Find the area, in square inches, of the figure shown below.


Mark your answer in the answer grid.
2. The figure below shows two shaded isosceles triangles in a square. The square has a perimeter of 32 inches.


What is the area, in square inches, of the two shaded isosceles triangles in the square?
3. The trapezoid shown below has an area of 66 square centimeters. What is the perimeter, in centimeters, of the trapezoid?


Mark your answer in the answer grid.

Mark your answer in the answer grid.
4. The coordinates of the vertices of figure $F G H J$ are $F\left(-2,{ }^{-} 4\right), G(-4,6)$, $H(6,6)$, and $J\left(8,{ }^{-4}\right)$.


What is the area, in square units, of figure $F G H J$ ?

Mark your answer in the answer grid.
5. The figure below shows rectangle $M N P Q$.


If $\overline{Q P}=10$ and the area of $\triangle M Q R$ is 35 square centimeters, what is the perimeter, in centimeters, of rectangle $M N P Q$ ?

Mark your answer in the answer grid.

# ARMT GRADE 8 MATHEMATICS 

## Answer Key

## Content Standard 10

## Sample Multiple-Choice

1. C
2. B
3. D
4. C
5. A

Sample Gridded

1. 163
2.32
2. 36
3. 100
4. 48

## MEASUREMENT

## Content Standard 11

Determine the surface area and volume of rectangular prisms, cylinders, and pyramids.

## Item Type

Multiple-choice
Open-ended

## Additional Information

Word problems/real-life situations may be used.
Drawings may be used.
A fractional representation of a real number may be used.

## Sample Multiple-Choice Items

1. What is the effect on the volume of a right cylinder if its radius is tripled?

A The volume is 3 times greater.
B The volume is 6 times greater.
C The volume is 9 times greater.*
D The volume is 12 times greater.
2. Marshall has a sandbox in the shape of a square prism, as shown below. The height of the sandbox is 10 inches.


If Marshall fills the sandbox with sand to a level height of 8 inches, what number of cubic inches of sand will be in the sandbox?

| 16,000 | 12,800 | 3200 | 2560 |
| :---: | :---: | :---: | :---: |
| $\mathbf{A}$ | $\mathbf{B}^{*}$ | $\mathbf{C}$ | $\mathbf{D}$ |

3. Albert has a container in the shape of a cube like the one pictured below.


What is the volume of the container in cubic inches?

## Sample Open-Ended Items

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.

1. Yolanda bought a fish tank, in the shape of a right rectangular prism, like the one pictured below.

a. Yolanda wants to put 2 inches of sand evenly in the bottom of the tank. What is the volume of the sand Yolanda will put in her fish tank?
b. After Yolanda puts 2 inches of sand in the bottom of the fish tank, she will put water in the tank, leaving 3 inches of space at the top. What is the volume of the water Yolanda will put into her fish tank?

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

## ARMT GRADE 8 MATHEMATICS

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.
2. Barry is painting the exterior of a tube. The tube is shaped like a cylinder with the dimensions shown below.

a. What is the surface area, in square inches, of the exterior of the tube?
b. One 1.5-ounce jar of paint covers 324 square inches. What is the minimum number of $\mathbf{1 . 5}$-ounce jars of paint needed to cover the exterior of the tube?

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

## ARMT GRADE 8 MATHEMATICS

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.

## 3. How many 1 -centimeter cubes will be needed to completely fill the empty rectangular prism shown below?



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

## ARMT GRADE 8 MATHEMATICS

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.
4. Marissa has two shapes she is painting for a project. For each of the two shapes, she will paint only the outside, including the lid.

- One shape is a cylindrical can with a radius of $\mathbf{3}$ inches and a height of 10 inches.
- The other shape is a rectangular prism-shaped box. The box is 4 inches wide, 6 inches long, and 5 inches high.

Which shape has the greater surface area for Marissa to paint?

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

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.
5. Mrs. Grimes is planning to paint the four walls of her classroom. Some information about the classroom is given below.

- The four walls are each 8 feet in height.
- The floor is rectangular and is $\mathbf{4 0}$ feet long and $\mathbf{3 0}$ feet wide.
- There is one door that is $\mathbf{3}$ feet wide and $\mathbf{7}$ feet in height.
- There are 3 windows that are each 3 feet wide and 4 feet in height.
a. What is the total surface area of the four walls, including the door and the windows?
b. One can of paint covers $\mathbf{4 5 0}$ square feet. If Mrs. Grimes does not paint the door or the windows, what is the minimum number of cans of paint she will need?

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

## ARMT GRADE 8 MATHEMATICS

## Answer Key

## Content Standard 11

## Sample Multiple-Choice

1. C
2. B
3. D
4. D
5. A
6. C

## MEASUREMENT

## Content Standard 12

Determine the lengths of missing sides and measures of angles in similar and congruent figures.

## Item Type

Multiple-choice
Gridded

## Additional Information

Diagrams may be included.
Use of the scale factor will be required.
Fraction or decimal representation of a real number may be used.
Determining the measurements of sides when the measurements of the sides are expressed as algebraic expression may be required.
Inscribed figures may be used.
Reflected (translated) figures may be used.

## Sample Multiple-Choice Items

1. Triangle $G H W$ is similar to triangle $J X Y$.


If $\angle W H G$ is $70^{\circ}$ and $\angle X J Y$ is $80^{\circ}$, what is the measure of $\angle G W H$ ?

| $10^{\circ}$ | $30^{\circ}$ | $140^{\circ}$ | $150^{\circ}$ |
| ---: | :---: | :---: | :---: |
| $\mathbf{A}$ | $\mathbf{B}^{*}$ | $\mathbf{C}$ | $\mathbf{D}$ |

2. In the figure below, $\triangle C D E$ is similar to $\triangle C A B$ as shown.


What is the length, in centimeters, of $x$ ?
10.4 cm
9.75 cm
A
9.0 cm
7.8 cm

B
C D*
3. In the figures below, $\triangle M N O$ is similar to $\triangle R S T$.


What is the length, in units, of $\overline{M O}$ ?

| 4 | 8 | 16 | 18 |
| :---: | :---: | :---: | :---: |
| $\mathbf{A}^{*}$ | B | C | D |

4. Manny wants to proportionally enlarge a rectangular window that has a length of 36 inches and a width of 24.5 inches.

If Manny enlarges the length of the window to 54 inches, what should be the width of the window?
A 79.0 inches
C 36.75 inches*
B 42.5 inches
D 24.5 inches
5. Two similar trapezoids are shown.


What is the value of $\boldsymbol{k}$ ?

| 6 cm | 10 cm | 12 cm | 13 cm |
| :---: | :---: | :---: | :---: |
| A | B | $\mathbf{C}^{*}$ | $\mathbf{D}$ |

6. Quadrilateral $W X Y Z$ is similar to quadrilateral $J M P H$.


What is the length, in feet, of $\overline{J M}$ ?
1.875
A
4.8
5
6
C
D
7. Triangle $D E F$ is similar to triangle $G H J$.


What is the measure of $\angle G$ ?
$39^{\circ}$
$45^{\circ}$
A
B*
$58.5^{\circ}$
$67.5^{\circ}$
C
D
8. In the figures below, $H J K L$ and $M N O P$ are similar parallelograms.


What is the length of $\boldsymbol{L K}$ ?
51.2 inches $\quad 31.25$ inches

A
B
27 inches
20 inches
C
D*
9. In the figure below, $G H K L$ and $M N P Q$ are similar rectangles.


What is the length of $\overline{\boldsymbol{L K}}$ ?

| 7.1 inches | 5.5 inches | 4.5 inches | 3.6 inches |
| :---: | :---: | :---: | :---: |
| $\mathbf{A}$ | $\mathbf{B}$ | $\mathbf{C}$ | $\mathbf{D}^{*}$ |

10. In the figure below, $\triangle J K L$ is similar to $\triangle J F G$ as shown.


What is the length, in centimeters, of $\overline{K L}$ ?
4.5
7.5
15
20
A
B*
C
D
11. In the figure below, trapezoid $E F G H$ is similar to trapezoid $W X Y Z$.


What is the length, in inches, of $\overline{\boldsymbol{F G}}$ ?
18
24
32
36
A
B
C*
D


## Sample Gridded Items

1. In $\triangle R S T$ point $W$ is on $\overline{R T}$, and $\overline{R S}$ is parallel with $\overline{W X}$.


If $S X=6$ inches, $X T$ equals 9 inches, and $W X$ is 6 inches, what is the length, in inches, of $\overline{R S}$ ?

Mark your answer in the answer grid.
2. In the figure below, $\triangle K M P$ is similar to $\triangle Q R S$, and the dotted line is a line of symmetry over which the triangles have been reflected.


What is the length, in units, of $\overline{S^{\prime} R^{\prime}}$ ?

Mark your answer in the answer grid.
3. In the figure below, $\Delta V W Z$ is congruent to $\Delta X Y Z$, and point $Z$ is on $\overline{Y W}$.


The measure of $\angle X Z Y$ is $45^{\circ}$ and the measure of $\angle Z W V$ is $115^{\circ}$. What is the measure of $\angle Y X Z$ ?

Mark your answer in the answer grid.
4. In triangles $K L M$ and $P Q R, \angle K$ and $\angle P$ are congruent, and the measures of $\angle L, \angle P$, and $\angle R$ add to $180^{\circ}$.


If $Q P=3$ inches, $Q R=8$ inches, $R P=6$ inches, and $K M=15$ inches, what is the length, in inches, of $\overline{L M}$ ?

Mark your answer in the answer grid.

## ARMT GRADE 8 MATHEMATICS

## Answer Key

## Content Standard 12

## Sample Multiple-Choice

1. B
2. D
3. $\mathbf{A}$
4. C
5. C
6. B
7. B
8. D
9. D
10. B
11. C
12. A

## Sample Gridded

1.10
2. 12
3. 20
4. 20

## DATA ANALYSIS AND PROBABILITY

## Content Standard 13

Interpret data from populations using given and collected data.

## Item Type

Multiple-choice
Open-ended

## Additional Information

Word problems/real-life situations may be used.
Drawing a graph to represent the data may be required.
Stem-and-leaf plots may be used.

## Sample Multiple-Choice Items

1. Sara recorded the temperature at her house over a five-hour period. Her graph is shown below.

Temperature over Five-Hour Period


According to the graph, which is closest to the change in temperature from 10:00 A.M. to 1:00 P.M.?

| $5^{\circ}$ | $7^{\circ}$ | $9^{\circ}$ | $12^{\circ}$ |
| :---: | :---: | :---: | :---: |
| $\mathbf{A}$ | $\mathbf{B}^{*}$ | $\mathbf{C}$ | $\mathbf{D}$ |

2. Which of the following would most likely be affected by the weather?

A


C*


B


D
Hot Dogs Sold in School Cafeteria

3. This stem-and-leaf plot shows the number of points scored by basketball players.

## Points Scored by Basketball Players

| 0 | 5 | 6 | 6 | 8 |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 1 | 0 | 1 | 3 | 3 | 5 | 9 |
| 2 | 0 | 1 | 1 | 3 | 7 |  |

1| 4 represents 14.
How many players scored more than 12 points?
6
7
8
9
A
B
C
D*
4. The circle graph below shows the percentages of Mrs. Frederick's monthly budget for July. Her total monthly income is $\mathbf{\$ 2 8 0 0}$.


In August's monthly budget, Mrs. Frederick spent \$126 more on clothes than she did in July. In August, what percentage of her monthly income of $\$ 2800$ was spent on clothes?
$15 \% \quad 12.5 \% \quad 11.5 \% \quad 10 \%$
A
B*
C
D

## 5. The stem-and-leaf plot shows

 the number of DVDs sold per day for 26 days at a video store.| DVDs Sold |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 2 |  | 4 | 5 | 7 | 9 |
| 3 | 1 | 1 | 2 | 3 | 6 |
| 4 | 0 | 3 | 3 | 3 | 58 |
| 5 | 2 | 4 | 4 | 6 | 7 |
| 6 | 0 | 3 | 5 | 5 | 6 |
| $2 \mid 2$ represents 22 |  |  |  |  |  |

Which conclusion can be drawn from this stem-and-leaf plot?

A The mode for the total number of DVDs sold per day was 65 .

B For $50 \%$ of these days, 45 or more DVDs were sold per day.

C The median for the total number of DVDs sold per day was 43.*

D There were exactly 12 days in which fewer than 40 DVDs were sold per day.

## Sample Open-Ended Items

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.

1. April used the graph below for a class presentation. She told the class, "Students spend twice as much time on homework on Thursdays as they do on Wednesdays."

Edna, one of April's classmates, stated, "I do not believe that you accurately displayed the results of your survey. The results can be displayed in a better way."

April replied that the statistics were displayed correctly.

a. Is April or Edna correct?
b. Make a different bar graph for April's project. How does your new display compare to April's original display?

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

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.
2. The following table shows what Jeremiah charges to baby-sit for a given number of hours.
Baby-Sitting

| Charge <br> (in dollars) | 7 | 12 | 22 | 27 |
| :--- | :---: | :---: | :---: | :---: |
| Number <br> of hours | 1 | 2 | 4 | 5 |

a. Make a scatter plot to represent this data. Clearly label your graph.
b. Using your graph, indicate whether there is or is not a relationship between the charge and the number of hours Jeremiah baby-sits.
c. Using this table and your graph, predict the charge if Jeremiah baby-sits for 8 hours.

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

## ARMT GRADE 8 MATHEMATICS

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.
3. The students at Johnson Middle School collected quarters for a charity over a 20-day period. The data below shows the number of quarters collected on different days.

$$
\begin{aligned}
& 30,21,58,37,46, \\
& 42,23,22,46,38, \\
& 35,48,29,33,41, \\
& 25,37,53,32,44
\end{aligned}
$$

a. Draw a stem-and-leaf plot or bar graph to organize the data from the list in increments of $\mathbf{1 0}$. Be sure to label all parts of your plot or graph.
b. In which increment or increments was the largest number of quarters collected?

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

## ARMT GRADE 8 MATHEMATICS

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.
4. Kyle is making a sales presentation to a grocery store. After surveying 90 people, Kyle created these two different graphs, shown below, showing customer preference for Brand $Y$ ice cream versus Brand $X$ ice cream, the current brand sold by the store.


a. If Kyle must have a graph for his presentation, which one of these graphs should Kyle choose and why?
b. Kyle has just learned that this data came only from current Brand Y customers. Explain how this information could affect the data.

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

## ARMT GRADE 8 MATHEMATICS

## Answer Key

## Content Standard 13

## Sample Multiple-Choice

1. B
2. C
3. D
4. B
5. C

## Sample Open-Ended

## 1. Sample Response(s):

a. The graph appears to show that students spend twice as much time on homework on Thursdays than on Wednesday. The vertical axis on April's display does not have a starting time and then goes to 40 and then 40 to 60 . Since it does not start at 0 , the appearance of the bars misrepresents the data. Edna is correct.
b.


My display is better, because I started the vertical axis at 0 ; therefore, the appearance of the bars accurately represents the data.

| Score Point | Response Attributes |
| :---: | :--- |
| $\mathbf{3}$ | All are correct. |
| $\mathbf{2}$ | The logic or explanation and the answer to the first part are correct. <br> OR |
| $\mathbf{1}$ | The graph and one logic are correct. |
| Graph has no more than three errors. |  |
| $\mathbf{0}$ | None correct. (Also, blanks, rewrites problem, foreign language, <br> illegible, refusals, off-task, etc., scored as invalid.) |

## DATA ANALYSIS AND PROBABILITY

## Content Standard 14

Determine the theoretical probability of an event.

## Item Type

Multiple-choice
Gridded

## Additional Information

Both "and" and "or" situations may be included.
Fraction and percent may be used.
Word problems/real-life situations may be used.

## Sample Multiple-Choice Items

1. Mrs. Zepeda has $\mathbf{1 1}$ boys and 9 girls in her history class. She will randomly select 1 student to help her grade papers.

What is the probability Mrs. Zepeda will select a girl to help her grade papers?
$\frac{11}{100} \quad \frac{11}{20} \quad \frac{9}{10} \quad \frac{9}{20}$
A
B
C
D*
2. Callie has 8 red marbles, 6 green marbles, 5 yellow marbles, and 6 blue marbles in a bag. There are no other marbles in the bag. All the marbles are the same size and shape.

Without looking, Callie will randomly select 1 marble from the bag.

What is the probability that Callie will select either a green or a blue marble from the bag?

| $\frac{3}{25}$ | $\frac{6}{25}$ | $\frac{12}{25}$ | $\frac{13}{25}$ |
| :---: | :---: | :---: | :---: |
| A | B | C* | D |

3. There are 4 math teachers, 6 language arts teachers, and 5 science teachers on the teachers' volleyball team. Each game, one teacher will be selected at random as team captain.

What is the probability a language arts teacher will be selected as team captain?

| $\frac{1}{15}$ | $\frac{4}{15}$ | $\frac{2}{5}$ | $\frac{2}{3}$ |
| :---: | :---: | :---: | :---: |
| A | B | C $^{*}$ | D |

4. Mr. Pizarro surveyed the 1600 students in his school to determine which one type of fruit each student preferred. The results of the survey are shown in the table below. One student who participated in the survey is selected at random.

Type of Fruit
Preferred by Students

| Preferred <br> Fruit | Number of <br> Students |
| :--- | :---: |
| Apples | 414 |
| Bananas | 280 |
| Grapes | 264 |
| Oranges | 440 |
| Watermelons | 202 |

What is the probability that the student selected at random preferred bananas or grapes?

| 0.26 | 0.34 | 0.42 | 0.58 |
| :---: | :---: | :---: | :---: |
| $\mathbf{A}$ | $\mathbf{B}^{*}$ | $\mathbf{C}$ | $\mathbf{D}$ |

5. Kerrie placed 6 red jelly beans, 5 blue jelly beans, 4 green jelly beans, and 5 black jelly beans in a jar. All jelly beans were the same shape and size. If Kerrie chooses 1 jelly bean at random from the jar, what is the probability that she will choose a red jelly bean?

| $\frac{6}{11}$ | $\frac{3}{10}$ | $\frac{1}{4}$ | $\frac{1}{5}$ |
| :---: | :---: | :---: | :---: |
| A | $\mathbf{B}^{*}$ | C | D |

6. Charlie has 3 blue markers, 6 red markers, 2 yellow markers, and 4 green markers in a box. What is the probability that Charlie will select at random a blue marker from the box?

| $\frac{4}{5}$ | $\frac{2}{5}$ | $\frac{1}{4}$ | $\frac{1}{5}$ |
| :---: | :---: | :---: | :---: |
| A | B | C | D $^{*}$ |

7. A picture of a game board used in Mr. Dudley's math class is shown below. Pennies are randomly tossed onto the game board when playing a probability game.

| B | A | D | B |
| :---: | :---: | :---: | :---: |
| D | B |  | C |
| C |  | A | B |
| $C$ |  |  |  |

What is the probability that a penny tossed on the first try will land on a space labeled B?
$\frac{5}{12}$
$\frac{2}{5}$
$\frac{1}{3}$
$\frac{1}{2}$
A*
B
C
D

## Sample Gridded Items

1. Caleb has 11 red marbles, $\mathbf{1 5}$ green marbles, 8 yellow marbles, 5 white marbles, 9 blue marbles, and 2 black marbles in a bag. There are no other marbles in the bag.

What is the probability that Caleb will select at random either a red or a black marble?

Mark your answer in the answer grid.
2. The sandwich menu at the school snack bar has 4 types of filling and 2 types of bread as shown in the table below.

- Types of Bread: White and Wheat
- Types of Filling: Turkey, Ham, Tuna, and Cheese

What is the probability a student will randomly select a sandwich with a ham filling on wheat bread?

Mark your answer in the answer grid.
3. In Mrs. Troyer's class, $20 \%$ of the girls wear glasses, and $15 \%$ of these girls have red hair.

If one girl is selected at random from Mrs. Troyer's class, what is the probability the girl will have red hair and wear glasses?

Mark your answer in the answer grid.
4. Antonio is playing a game with a deck of $\mathbf{5 0}$ cards. There are 5 colors in the deck. Each color has $\mathbf{1 0}$ cards. These are the rules for Antonio's game:

- The pink and brown cards are numbered 1 to 10 and have the same value as the number on the card.
- The orange and green cards all have a value of 5 .
- The black cards all have a value of 10 .

Antonio shuffled the deck and randomly selected a brown card numbered 6. He shuffled the brown card back into the deck and randomly dealt 1 card to Carla.

What is the probability that Carla's card has a value more than Antonio's card?

Mark your answer in the answer grid.
5. Jenna has 5 shirts: 1 red, 1 yellow, 1 blue, 1 green, and 1 black.

She also has $\mathbf{3}$ pairs of pants: 1 black, 1 brown, and 1 blue.
If Jenna selects 1 shirt and 1 pair of pants at random, what is the probability she will select a black shirt and a pair of black pants?

Mark your answer in the answer grid.

## ARMT GRADE 8 MATHEMATICS

## Answer Key

## Content Standard 14

Sample Multiple-Choice

1. D
2. C
3. C
4. B
5. B
6. D
7. A

## Sample Gridded

1. $\frac{13}{50}=0.26=26 \%$
2. $\frac{1}{8}=0.125=12.5 \%=12 \frac{1}{2} \%$
3. $\frac{3}{100}=0.03=3 \%$
4. $\frac{18}{50}=\frac{36}{100}=\frac{9}{25}=0.36=36 \%$
5. $\frac{1}{15}=0.067=6.7 \%$
