

ACTAAP

Arkansas
Comprehensive Testing, Assessment
& Accountability Program

***Algebra I Spring
End of Course Examination
Released Item Booklet***

April 2004 Administration

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Arkansas Department of Education

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PART I Overview

The criterion-referenced tests implemented as part of the **Arkansas Comprehensive Testing, Assessment and Accountability Program** (ACTAAP) have been developed in response to Arkansas Legislative Act 1172, which requires the State Board of Education to develop a comprehensive testing program that includes performance assessment of the core concepts, abilities, thinking, and problem-solving skills defined by the *Arkansas Mathematics Curriculum Framework* and the Algebra I Course Goals.

As part of this program, students in Arkansas public schools who had completed or were completing Algebra I by the end of the spring semester participated in the *Algebra I Spring End of Course Examination* in April of 2004.

This *Released Item Booklet* for the *Algebra I Spring End of Course Examination* contains test questions or items that were asked of students during the April 2004 administration. The test items included in this booklet are those items that contributed to the student performance results for that administration.

Students had approximately forty-five minutes for each session, 1 through 4, and thirty minutes to take Session 5 during one day of testing in April of 2004. 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 page 33 of this booklet). **All of the multiple-choice items in Part II of this booklet have the correct response marked with an asterisk(*).** The open-response questions in Part III of this booklet include scoring guides (rubrics) immediately following. These rubrics provide information on the scoring model used for the Algebra I open-response test items.

The development of the *Algebra I Spring End of Course Examination* was based on the *Arkansas Mathematics Curriculum Framework* and the Algebra I Course Goals. This framework has common distinct levels: *strands* to be taught in concert, *content standards* within each strand, and *student learning expectations* within each content standard. The Algebra I Course Goals, an abridged version of the *Arkansas Mathematics Curriculum Framework*, can be found in Part IV of this booklet. It is important to note that this abridged version lists only the predominant strand, content standards, and student learning expectations associated with test items. However, since many key concepts within the *Arkansas Mathematics Curriculum Framework* are interrelated, in many cases there are other item correlations or associations across strands, standards, and expectations.

Part V of the *Released Item Booklet* contains a tabular listing of the content standard and student learning expectation that each Algebra I question was designed to assess within the Patterns, Algebra & Functions Strand. The multiple-choice and open-response items found on the *Algebra I Spring End of Course Examination* were developed in close association with the Arkansas education community. Arkansas teachers participated as members of the Algebra I Content Advisory Committee, providing routine feedback and recommendations for all items. The number of items associated with specific 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 V of the *Released Item Booklet* provides Arkansas educators with specific information on how the *Algebra I Spring End of Course Examination* items align or correlate with the *Arkansas Mathematics Curriculum Framework* to provide models for classroom instruction.

1. Find the value of the expression:

$$4 + 2^3 + (3 + 9) \div 4$$

A. $5\frac{1}{2}$

B. $7\frac{1}{2}$

C. 13

* D. 15

2. The amount of methylmercury in a human body can be measured by analyzing a person's blood sample. The following data set represents the amounts of methylmercury, in micrograms, found in the individual blood samples of eight people.

$$\{45, 35, 50, 21, 45, 35, 45, 40\}$$

What is the mode of this data set?

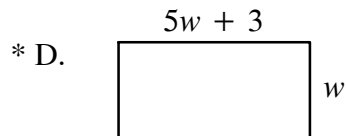
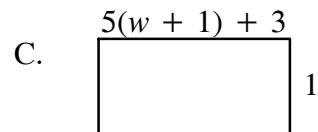
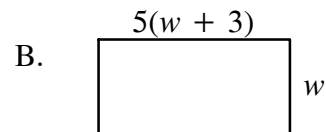
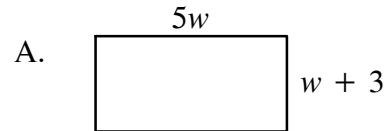
A. 35

B. 39.5

* C. 45

D. 425

3. A rectangle has a length that is 3 more than 5 times the width. Which diagram correctly illustrates this sentence?



Use the table below to answer question 4.

	A	B	C	D	E	F	G	H	I
1	1	2	3	4					
2	2	4	9	16					
3	3	8	27	64					
4	4	16	81	256					
5	5	32	243	1,024					
6	6	64	729	4,096					
7	7	128	2,187	16,384					
8	8	256	6,561	65,536					

4. Evaluate this expression using the table above: $4(D8 \cdot A1 \cdot B6)$

- A. 1,679,616
- B. 4,194,304
- * C. 16,777,216
- D. 47,775,744

5. A sports store bought a case of baseballs for \$250.00. The profit the store makes from the baseballs is represented by the function $p = 2b - 250$, where p represents the profit and b represents the number of baseballs. What is the range of this function when the domain is $\{50, 125, 200, 250\}$?

- A. $\{350, 500, 650, 750\}$
- B. $\{150, 0, 150, 250\}$
- * C. $\{-150, 0, 150, 250\}$
- D. $\{150, 187\frac{1}{2}, 225, 250\}$

6. Rewrite the number 0.000000512 using scientific notation.

- A. 0.512×10^{-7}
- * B. 5.12×10^{-7}
- C. 0.512×10^7
- D. 5.12×10^7

7. Which of the following is an integer?

A. $\sqrt{2}$

* B. 3

C. 5.4

D. $6\frac{2}{3}$

8. A school bus took $2\frac{3}{4}$ hours to drive to the nearest amusement park located 135 miles away. What was the approximate rate at which the bus traveled?

* A. 49 mph

B. 52 mph

C. 55.6 mph

D. 57.7 mph

9. Simplify:

$$\begin{bmatrix} 0 & 2 & 3 \\ 1 & -1 & 2 \\ 4 & -2 & 5 \end{bmatrix} - 2 \begin{bmatrix} 5 & -4 & 3 \\ 2 & 0 & -2 \\ 1 & -1 & 3 \end{bmatrix}$$

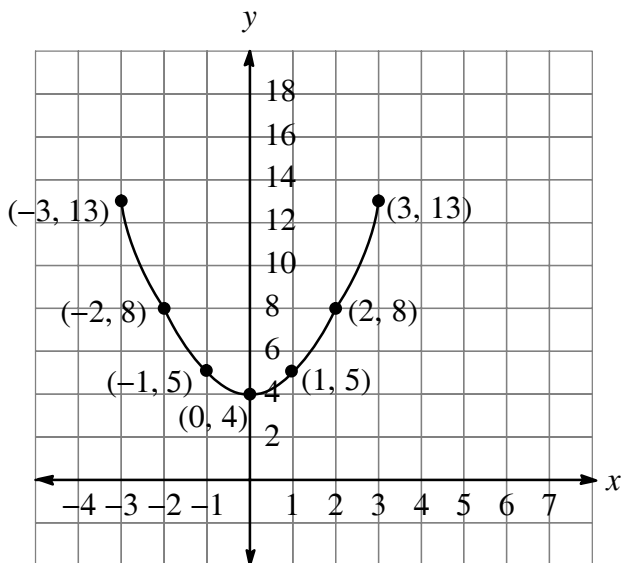
* A. $\begin{bmatrix} -10 & 10 & -3 \\ -3 & -1 & 6 \\ 2 & 0 & -1 \end{bmatrix}$

B. $\begin{bmatrix} 3 & -4 & 4 \\ 1 & -3 & -2 \\ 3 & -5 & 6 \end{bmatrix}$

C. $\begin{bmatrix} -10 & -8 & -9 \\ -3 & -3 & -2 \\ 2 & -4 & -1 \end{bmatrix}$

D. $\begin{bmatrix} -10 & 9 & -2 \\ -2 & -1 & 2 \\ 1 & 0 & -1 \end{bmatrix}$

Use the graph below to answer question 10.



10. The function $y = x^2 + 4$ is shown above. What is the range of the graph shown?

- A. $\{y: 4 \leq y\}$
- * B. $\{y: 4 \leq y \leq 13\}$
- C. $\{y: 4 \geq y \geq 13\}$
- D. $\{y: 13 \leq y\}$

11. The cost of renting a car at Ace Auto Rentals is \$45 a day plus \$0.05 a mile. What is the expression for total cost if d is the number of days and m is the number of miles driven?

- * A. $45d + .05m$
- B. $45d(.05m)$
- C. $45.05(d + m)$
- D. $45.05dm$

12. At what points does the graph of $y = x^2 - 4$ intersect the x -axis?

- A. $(0, 0)$ and $(0, -4)$
- B. $(0, -4)$ and $(-2, 0)$
- * C. $(-2, 0)$ and $(2, 0)$
- D. $(0, -4)$ and $(2, 0)$

13. Jordan has some **square** pieces of carpet that measure 4 feet on a side. He puts three of them together, end to end, to form a **rectangle** in front of his workbench. What is the perimeter of this rectangle?

- * A. 32 feet
- B. 32 feet²
- C. 48 feet
- D. 48 feet²

14. A movie theater charges \$7 for adult tickets (a) and \$4 for children's tickets (c). Last Friday the theater sold 272 tickets and collected \$1,694. Which of the following systems of equations is a correct representation of this data?

- A. $\begin{cases} a + c = 1,694 \\ 7a + 4c = 272 \end{cases}$
- * B. $\begin{cases} a + c = 272 \\ 7a + 4c = 1,694 \end{cases}$
- C. $\begin{cases} 272a + 1,694c = 4 \\ a + c = 7 \end{cases}$
- D. $\begin{cases} 7a + 4c = 272 \\ 11a + 11c = 1,694 \end{cases}$

15. Which set of ordered pairs is a function?

- A. $\{(1, 2), (2, 4), (1, 4)\}$
- B. $\{(1, 2), (4, 2), (4, 3)\}$
- * C. $\{(1, 5), (2, 7), (3, 5)\}$
- D. $\{(3, 0), (3, -1), (0, 3)\}$

16. Completely factor:

$$x^2 + x - 6$$

- * A. $(x + 3)(x - 2)$
- B. $(x - 3)(x + 2)$
- C. $(x + 6)(x - 1)$
- D. $(x - 6)(x + 1)$

17. Which represents an equation?

- A. 3 times a number plus 5
- * B. 5 times a number equals 3
- C. 7 and the sum of x and 3.14
- D. 3.14 and the product of 7 and x

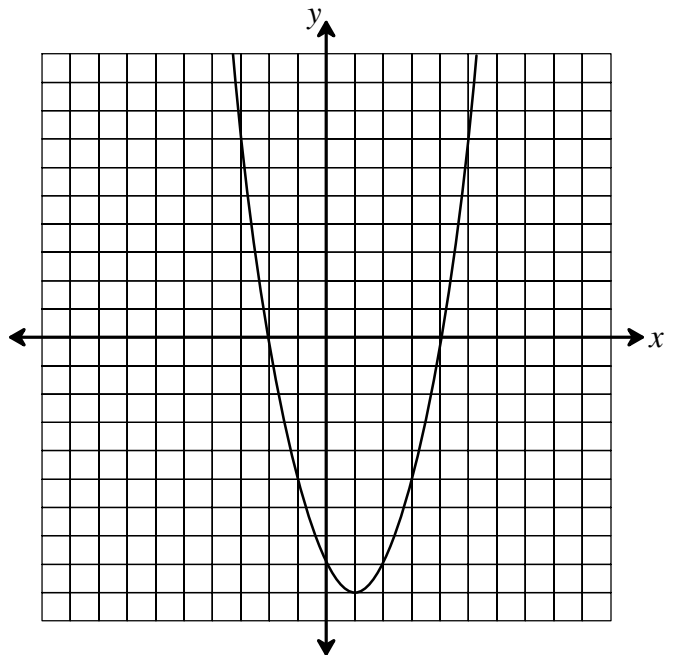
18. Jake is training for an in-line skate race. His goal is to skate at least 100 miles each week. Jake could only skate 7 miles on Monday. What is the fewest number of miles he must average for each of the next six days to achieve his goal?

- A. 14.3 miles
- * B. 15.5 miles
- C. $16.\bar{6}$ miles
- D. $17.8\bar{3}$ miles

19. The total cost of stamps is a function of how many stamps are purchased. Which statement is true?

- * A. The total cost of stamps is the dependent variable.
- B. The total cost of stamps is the independent variable.
- C. The number of stamps purchased is the dependent variable.
- D. There is no relation between the number of stamps purchased and the total cost.

Use the graph below to answer question 20.



20. The graph above represents the equation $y = x^2 - 2x - 8$. What is the solution to $x^2 - 2x - 8 = 0$?

- A. $x = -8$
- B. $x = 2, x = 4$
- * C. $x = -2, x = 4$
- D. $x = -8, x = -2, x = 4$

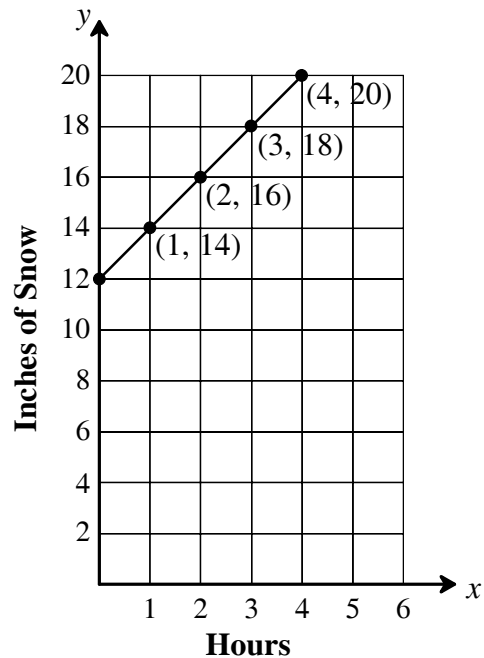
21. If $x = 3$ in the expression $5x + 2y = 7$, what is the value of y ?

A. -8
 * B. -4
 C. 4
 D. 8

22. What is the product of a and b ?

A. $a + b$
 B. $a - b$
 * C. ab
 D. $\frac{a}{b}$

- Use the graph below to answer question 23.



23. When snow is 12 inches deep on a ski slope, a snow-making machine begins to produce snow at a constant rate as shown in the graph above. At what rate is snow produced?

A. $\frac{1}{2}$ inch per hour
 * B. 2 inches per hour
 C. 8 inches per hour
 D. 26 inches per hour

PART II Released Multiple-Choice Items — Algebra I

24. A taxi cab driver charges \$2.00 per trip plus \$0.50 per mile. The distance traveled is x miles. Which function represents the cost of a trip?

- A. $f(x) = 5x + 2$
- * B. $f(x) = 0.5x + 2$
- C. $f(x) = 50x + 2$
- D. $f(x) = 2x + 0.50$

25. 70,000 football fans each spent approximately \$500 on tickets, food, and lodging for the recent playoff game. What was the total amount spent?

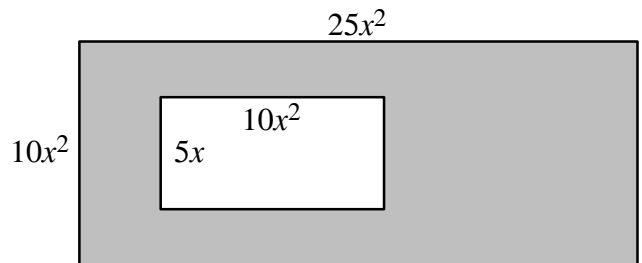
- A. $\$3.5 \times 10^5$
- B. $\$3.5 \times 10^6$
- * C. $\$3.5 \times 10^7$
- D. $\$3.5 \times 10^8$

26. If $j = 4$ and $k = 3$, what is m ?

$$m = \frac{j^k}{(\sqrt{j})^k}$$

- A. 1
- * B. 8
- C. $\frac{81}{8}$
- D. 512

Use the figure below to answer question 27.



27. All figures shown above are rectangles. What is the area of the shaded region?

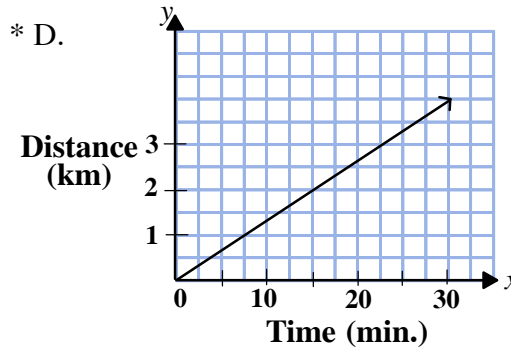
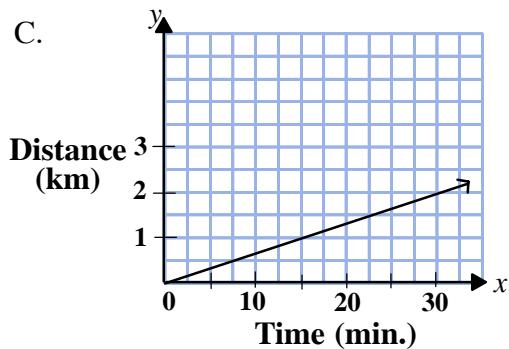
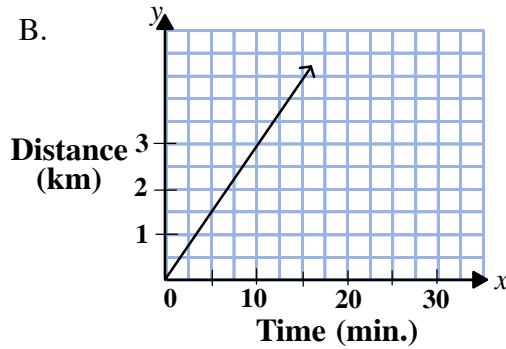
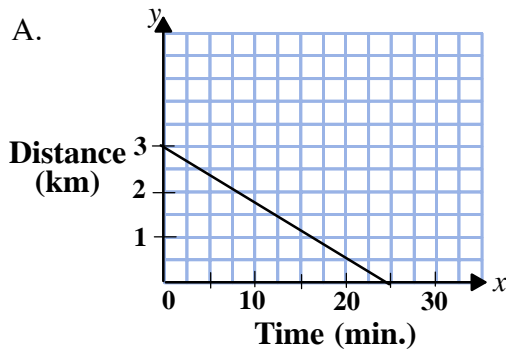
- A. $35x^4 - 50x^3$ units²
- B. $35x^4 - 15x^3$ units²
- * C. $250x^4 - 50x^3$ units²
- D. $250x^4 - 15x^3$ units²

PART II Released Multiple-Choice Items — Algebra I

Use the table below to answer question 28.

Time t (Minutes)	Distance d (Kilometers)
3	0.435
5	0.725
10	1.450
12	1.740
17	2.465

28. Mr. Jones is keeping track of his speed (in km per hour) on his exercise bike. Which graph below best fits the data?



29. Which table of values represents a function?

* A.

x	-2	-1	0	1
y	2	2	2	2

B.

x	2	2	2	2
y	4	3	2	1

C.

x	-2	-1	0	-1
y	3	2	3	3

D.

x	2	1	2	1
y	5	-4	4	5

30. Completely factor the following polynomial:

$$16x^3y - 32x^2y^2 + 12xy^3$$

- A. $x^2y^2(16x - 32 + 12y)$
 B. $12(4x^3y - 20x^2y^2)$
 C. $16x(x^2y - 2xy^2 - 4y^3)$
 * D. $4xy(2x - y)(2x - 3y)$

31. Translate this verbal sentence into an inequality:

The sum of twice a number and 25 is greater than or equal to 50.

- A. $2x + 25 < 50$
 B. $2x + 25 \leq 50$
 C. $2x + 25 > 50$
 * D. $2x + 25 \geq 50$

32. Michelle is taking a trip to Japan. She wants to use Japanese yen to pay for souvenirs. The currency rate is $\$1.00 = 120$ yen. The bank charges $\$20$ as a service fee to exchange currency. Michelle spent $\$250$ to convert her dollars to yen. How many yen did she receive?

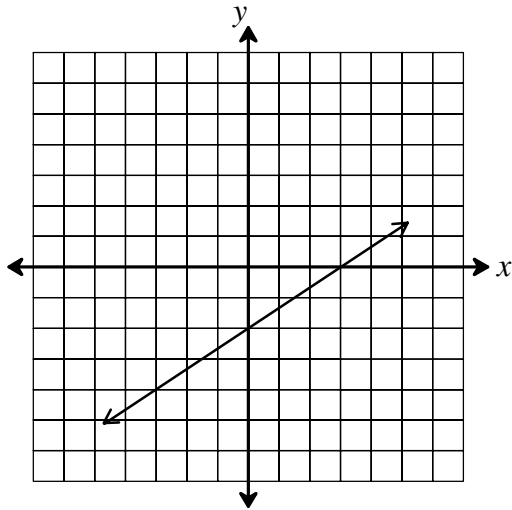
- A. 2.5 yen
 * B. 27,600 yen
 C. 30,000 yen
 D. 32,400 yen

33. What is the mean of the set of data below?

$$\{1, 17, 3, 5, 9, 5, 15, 7, 10\}$$

- A. 5
 B. 7
 * C. 8
 D. 9

Use the graph below to answer question 34.



34. What is the zero of the function graphed above?

- A. $x = -2$
- B. $x = 0$
- C. $x = 1$
- * D. $x = 3$

35. Solve: $y^2 + 8y + 15 = 0$

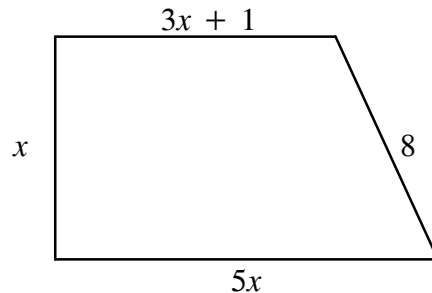
- A. $y = -3$ or $y = 5$
- B. $y = 3$ or $y = -5$
- * C. $y = -3$ or $y = -5$
- D. $y = 3$ or $y = 5$

36. Which would be the **best** first step in solving the following problem?

$$5(x - 3) = 100$$

- A. subtract 3 from both sides of the equation
- B. add 3 to both sides of the equation
- * C. distribute the 5 throughout the parentheses
- D. multiply by 5 on both sides of the equation

Use the figure below to answer question 37.

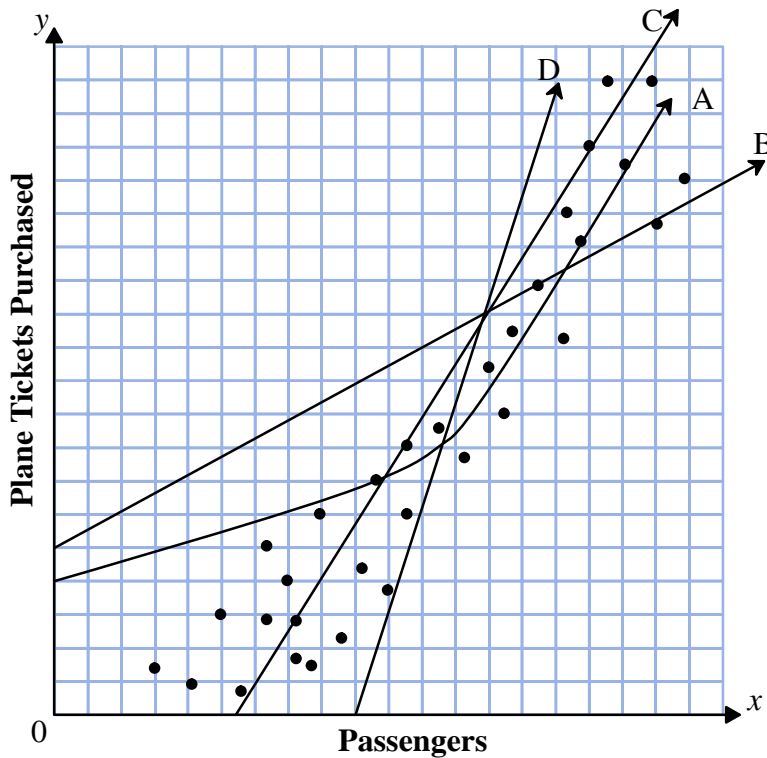


(Not drawn to scale.)

37. What is the value of x if the perimeter of the figure shown above is 36?

- A. 2
- * B. 3
- C. 4
- D. 5

Use the graph below to answer question 38.



38. Which is the most reasonable line of best fit for the scatterplot shown above?

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

39. Lots O' Videos charges a \$20 annual membership fee and \$1.50 for each video rented. Video House only charges \$9 for membership, but they charge \$2 for each video rented. If the cost at both stores was the same, which equation could be used to determine the number of videos rented (v)?

- A. $1.50 + 20v = 2 + 9v$
- B. $3.50v = 29$
- * C. $20 + 1.50v = 9 + 2v$
- D. $v = 29 + 3.50v$

40. Which of the following expressions is equivalent to $3x + 7x$?

- A. $10x^2$
- * B. $10x$
- C. $21x$
- D. $3x(1 + 4x)$

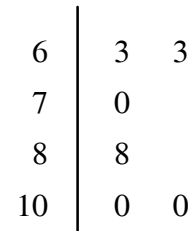
41. Which of the following numbers is **not** a prime number?

- A. 3
- B. 5
- * C. 6
- D. 17

42. A science class conducted an experiment in which a solution with a boiling point of 112°F was left in a car on a sunny day. At 8:00 A.M., the temperature was 84°F . The class found the temperature increased 8°F per hour. At what time would the solution reach the boiling point?

- A. 11:00 A.M.
- * B. 11:30 A.M.
- C. 12:00 P.M.
- D. 3:30 P.M.

Use the plot below to answer question 43.



43. Which set of data was used to construct the stem-and-leaf plot shown above?

- A. 63, 63, 70, 88, 100
- B. 63, 63, 70, 88, 88, 100
- * C. 63, 63, 70, 88, 100, 100
- D. 70, 88, 100, 100, 633

44. What is the domain of the following set of ordered pairs?

$\{(0, 4), (1, 5), (2, 12), (3, 31)\}$

- A. $\{4, 5, 12, 31\}$
- B. $\{4, 6, 14, 34\}$
- C. $\{2, 3, 4, 5\}$
- * D. $\{0, 1, 2, 3\}$

45. Simplify the expression:

$$(18x^3 + 25x^2 + 12x + 100) - (9x^3 + 6x^2 + 12x)$$

- * A. $9x^3 + 19x^2 + 100$
- B. $27x^3 + 31x^2 + 24x + 100$
- C. $9x^3 + 31x^2 + 12x + 100$
- D. $27x^3 + 19x^2 + 100$

46. Jim works in a sporting goods store. He earns an hourly wage plus commission. One week last October, Jim worked for 15 hours and earned \$72.50 in commission. If his total earnings were \$166.25, which equation can be used to determine Jim's hourly wage?

- A. $72.50x + 15 = 166.25$
- * B. $15x + 72.50 = 166.25$
- C. $15x - 72.50 = 166.25$
- D. $15x + 166.25 = 72.50$

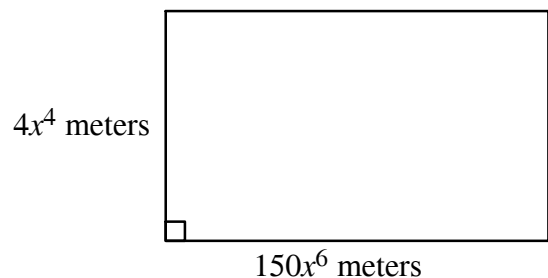
Use the formula below to answer question 47.

$$\text{Surface Area} = 6 \times (\text{edge})^2$$

47. The surface area of a cube is 384. What is the length of one edge?

- A. 3
- * B. 8
- C. $10\frac{2}{3}$
- D. 18

Use the figure below to answer question 48.



48. What is the area of the rectangle above?

- A. $154x^{10} \text{ m}^2$
- B. $154x^{24} \text{ m}^2$
- * C. $600x^{10} \text{ m}^2$
- D. $600x^{24} \text{ m}^2$

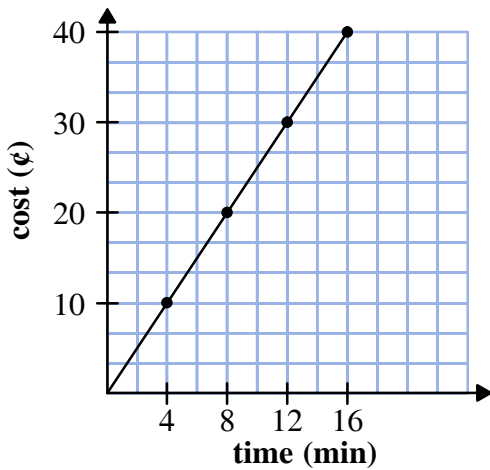
49. Tom is paid 2 cents on his first day of work. His pay doubles each succeeding day. How much will Tom earn on his fifth day of work?

- A. 4¢
- B. 10¢
- C. 25¢
- * D. 32¢

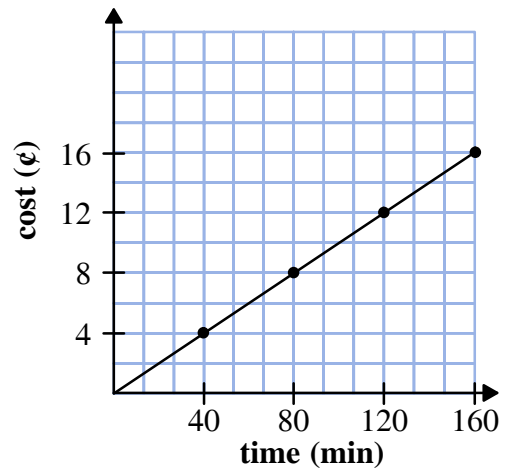
PART II Released Multiple-Choice Items — Algebra I

50. A telephone company charges 10¢ per minute for long distance phone calls. Which graph represents a 16-minute long distance phone call from Charlotte to Chicago?

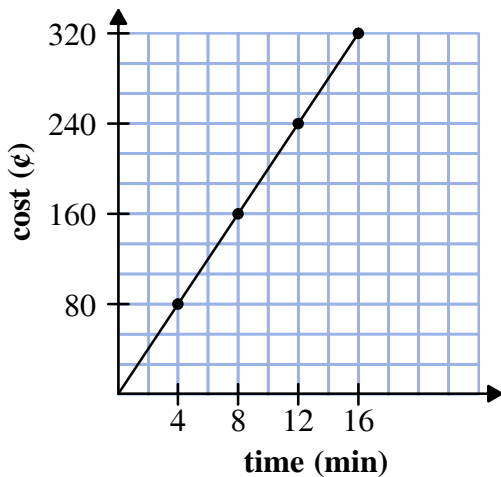
A.



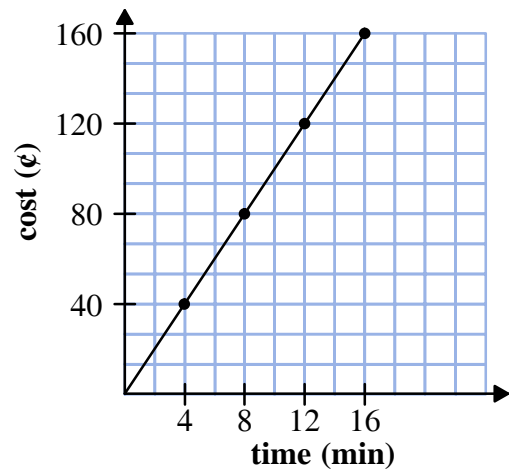
B.



C.



* D.



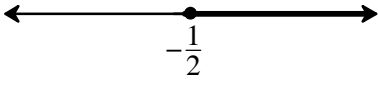
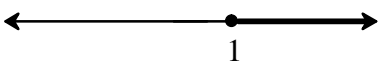
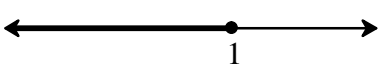

51. What is the greatest common factor in the polynomial below?

$$2a^4b + 6a^2b^2 - 10ab^2$$

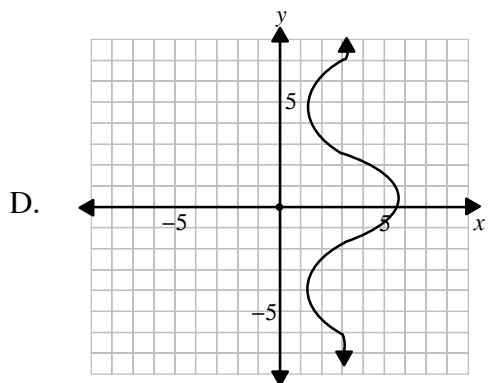
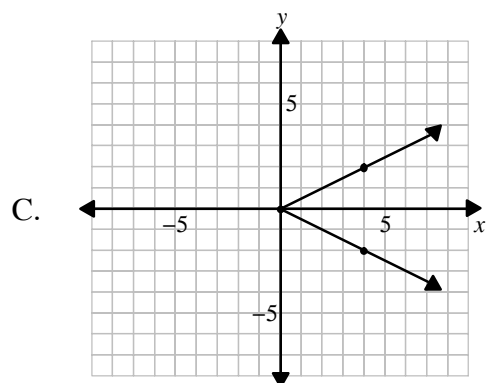
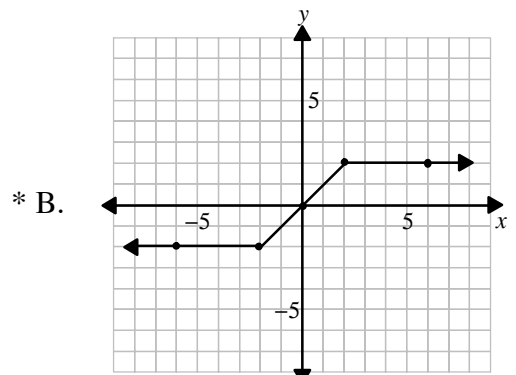
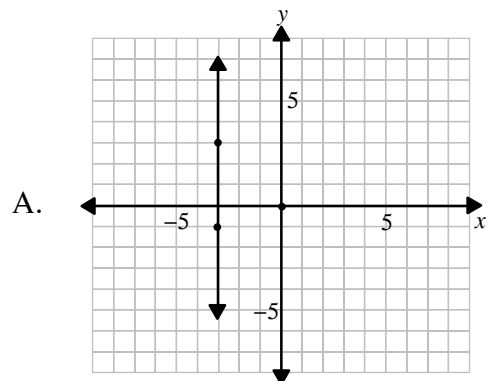
- A. $2a^2$
 * B. $2ab$
 C. ab
 D. $2a^2b$
52. Today Mary has 6 less than one half the number of marbles she had yesterday. Which expression represents the number of marbles Mary has today?

- A. $m - 3$
 B. $2m - 3$
 C. $6 - \frac{m}{2}$
 * D. $\frac{m}{2} - 6$

53. Solve and graph: $-4x - 3 \leq -1$

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

54. Which of the following is the graph of a function?



Use the matrix below to answer question 55.

Bill's Clothes Barn

	Solid	Striped	Plaid
Shirts	8.00	16.00	26.00
Slacks	12.00	21.00	33.00

55. The matrix above represents the prices Bill's Clothes Barn paid for shirts and slacks. The store increases these prices 75% before selling them to customers. Which matrix represents the selling prices of the shirts and slacks?

- A. $\begin{bmatrix} 6.00 & 12.00 & 19.00 \\ 9.00 & 15.75 & 24.75 \end{bmatrix}$
- B. $\begin{bmatrix} 2.00 & 4.00 & 6.50 \\ 3.00 & 5.25 & 8.25 \end{bmatrix}$
- * C. $\begin{bmatrix} 14.00 & 28.00 & 45.50 \\ 21.00 & 36.75 & 57.75 \end{bmatrix}$
- D. $\begin{bmatrix} 10.00 & 20.00 & 32.50 \\ 15.00 & 26.25 & 41.25 \end{bmatrix}$

56. Principal Greene has received a \$1,500 grant to buy new printers at his school. He has a choice between \$50 color printers and \$130 high-resolution laser printers. He wants at least 20 new printers. If C represents the number of color printers and L represents the number of laser printers, which set of inequalities correctly models the situation?

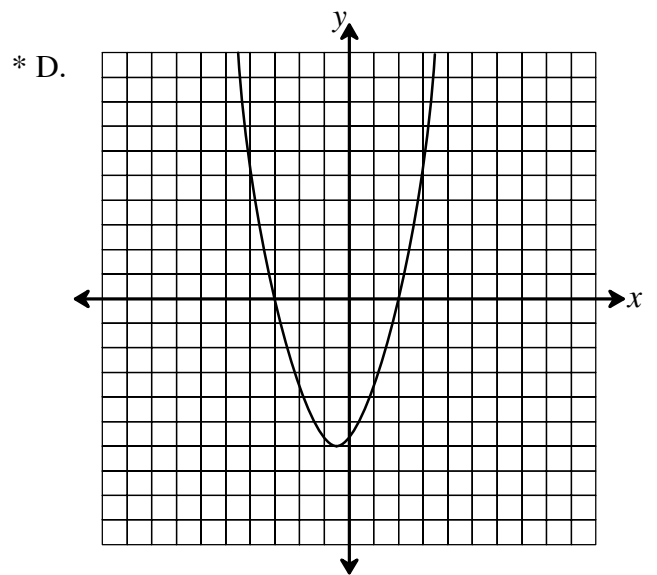
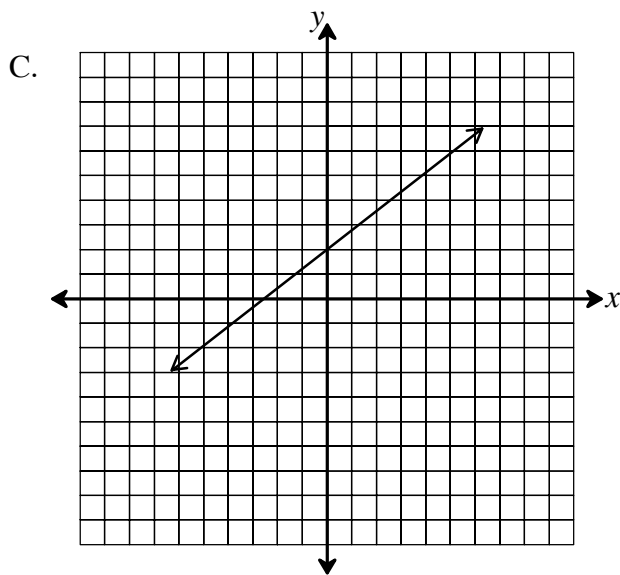
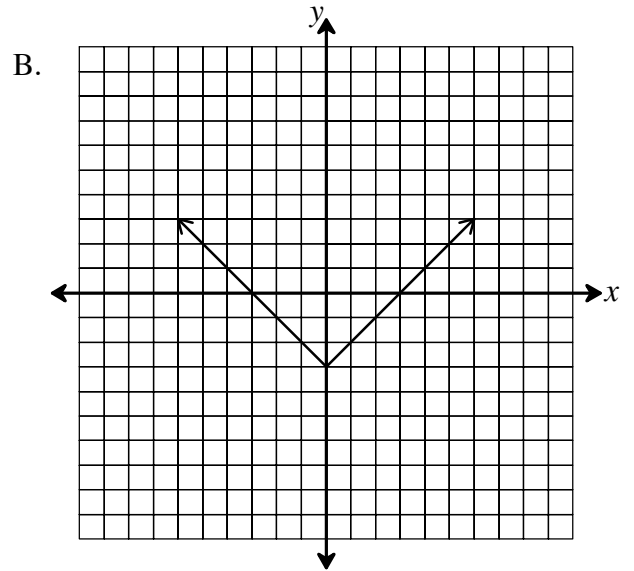
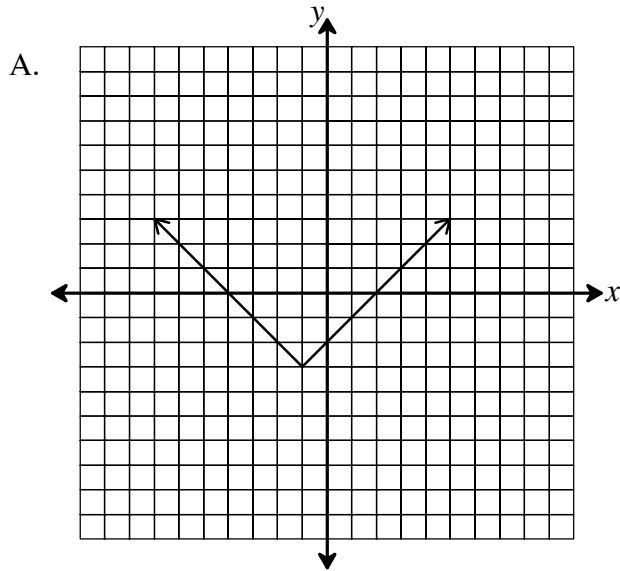
- * A. $\begin{cases} 50C + 130L \leq 1,500 \\ C + L \geq 20 \end{cases}$
- B. $\begin{cases} 50C + 130L \geq 1,500 \\ C + L \leq 20 \end{cases}$
- C. $\begin{cases} 50C + 130L \leq 20 \\ C + L \geq 1,500 \end{cases}$
- D. $\begin{cases} 50C + 130L \geq 20 \\ C + L \leq 1,500 \end{cases}$

Use the information below to answer question 57.

Mohammed	21 in.	Tiffany	28 in.
Shannon	22 in.	Veronica	22 in.
Danielle	25 in.	Saida	23 in.
Derrick	28 in.	Lamar	28 in.

57. Eight students measured the distance between each of his or her steps when walking. The results are shown above. What is the median of the data?
- A. 23.5
- * B. 24
- C. 24.6
- D. 28

58. Which function has -3 and 2 as zeros?



59. Simplify:

$$-2x(x^2 - x - 4)$$

- A. $x^2 - 3x - 4$
- B. $x^2 - 7x$
- * C. $-2x^3 + 2x^2 + 8x$
- D. $2x^3 - 2x^2 - 8x$

60. How is 1.811×10^4 written in standard notation?

- A. 0.0001811
- B. 7.244
- C. 10.76
- * D. 18,110

CALCULATOR PERMITTED ON ALL ITEMS

ALGEBRA I OPEN-RESPONSE ITEM A

- A. A camper can be rented for \$150 for the first day plus \$110 for each additional day. The table below shows the rates for renting the camper.

Number of Days	Total Cost
1	\$150
2	\$260
3	\$370
4	\$480
5	
6	

1. Copy and complete the table above in your Student Answer Document. Show or explain all of your work even if you use mental math or a calculator.
2. Let C represent the cost of renting the camper for d days. Write the equation for the cost of renting the camper. Explain all of your work.
3. The camper can be purchased for \$5,400. Your family is planning a 45-day trip. Determine whether renting or buying the camper is the least expensive option. Show or explain all of your work even if you use mental math or a calculator.

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

RUBRIC FOR ALGEBRA I OPEN-RESPONSE ITEM A

SCORE	DESCRIPTION
4	The student earns 4 points.
3	The student earns 3 – 3.5 points.
2	The student earns 2 – 2.5 points.
1	The student earns .5 – 1.5 points. OR The response demonstrates minimal understanding of translating word expressions to symbolic expressions.
0	No understanding. Work is either incorrect or irrelevant.
Blank	No response.

Score Point Description:

Part 1: Score **1 point** for both correct entries on the table with work or explanation demonstrating the understanding that the cost increases (\$)110 per day.

OR

Score **.5 point** for both correct entries with no work or explanation; **or** for work or explanation demonstrating the understanding that the cost increases (\$)110 per day with incorrect entry(ies) due to calculation error(s).

Part 2: Score **1 point** for correct equation.

OR

Score **.5 point** for correct expression; **or** for the correct equation but student makes a calculation error in attempt to simplify; **or** for correct equation using variables other than the given variables.

Part 3: Score **2 points** for correct conclusion with complete support.

OR

Score **1 point** for correct conclusion with incomplete support; **or** for correct and complete support for reaching the correct conclusion, but no or the incorrect conclusion is given; **or** for work or explanation demonstrating correct procedures for determining the correct conclusion, but work contains calculation error(s). (Conclusion must be given and based on work shown.)

OR

Score **1 point** for conclusion with work shown using an incorrect equation, due to a procedural error, in part 2 (may contain calculation errors).

Sample Solution:

Part 1: Day 5: **(\$)590** ($480 + 110 = 590$)
Day 6: **(\$)700** ($590 + 110 = 700$)
Or, total cost increases by \$110 per day.

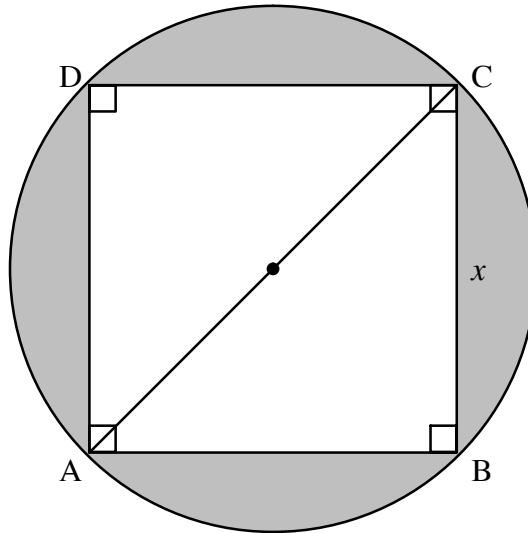
Part 2: $C = 150 + 110(d - 1)$ OR $C = 40 + 110d$

Part 3: Cost of renting for 45 day trip ($d = 45$):
 $C = 150 + 110(45 - 1) = 150 + 110(44) = \$4,990$
Since the cost of renting for 45 days (\$4,990) < Cost of purchasing the camper (\$5,400), renting would be the least expensive option.

Note: No credit is given to a conclusion in part 3 with no or obviously incorrect support.

ALGEBRA I OPEN-RESPONSE ITEM B

- B. A charcoal grill is designed to have the largest possible square-shaped cooking surface to fit inside the hemispherical container. The top view of the grill is shown below. The cooking surface is ABCD.



1. Henry needs to know the distance from A to C in order to determine how much food will fit on the grill. He finds that the radius of the circle is 12 inches. Determine the distance from A to C. Show or explain all of your work even if you use mental math or a calculator. Be sure to show units.
2. Find the length, x , of each side of the square rack. Show or explain all of your work even if you use mental math or a calculator. Be sure to show units. You may find it helpful to use a sketch.
3. Henry wants to cover the metal grill with cooking foil. Determine if his $1\frac{1}{4}$ ft. by $1\frac{1}{4}$ ft. piece of foil will cover the square-shaped cooking surface. Show or explain all of your work even if you use mental math or a calculator. Be sure to show units.

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

RUBRIC FOR ALGEBRA I OPEN-RESPONSE ITEM B

SCORE	DESCRIPTION
4	The student earns 5 points.
3	The student earns 4 – 4.5 points.
2	The student earns 2 – 3.5 points.
1	The student earns .5 – 1.5 points. OR The response demonstrates minimal understanding of integrating algebra and geometry in problem solving (shows understanding of using appropriate formulas for simple geometric figures).
0	No understanding. Work is either incorrect or irrelevant.
Blank	No response.

Score Point Description:

- Part 1:** Score **1 point** for correct answer with work shown.
OR
Score **.5 point** for correct answer with no or incomplete work shown; **or** for correct procedure shown with an incorrect answer due to calculation error(s).
- Part 2:** Score **2 points** for correct answer with work shown (may be based on an incorrect answer to part 1).
OR
Score **1 point** for correct answer with no or incomplete work shown; **or** for correct procedure shown with an incorrect answer due to calculation error(s).
- Part 3:** Score **2 points** for correct conclusion with complete support (correctly finds either the area or the dimensions (in inches) for the foil, then makes the appropriate comparison).
OR
Score **1 point** for correct conclusion with incomplete support; **or** for correct and complete support necessary to determine if the foil will cover the square cooking surface with incorrect or no conclusion given; **or** for work or explanation demonstrating correct procedures for determining the correct conclusion, but work contains calculation error(s). (Conclusion must be given and based on work shown.)

Sample Solution:

Part 1: If the radius of the circle is 12 inches, then the distance from A to C, which is the diameter of the circle is: $2(12\text{inches}) = \mathbf{24\text{ inches}}$

Part 2: $x^2 + x^2 = 24^2$
 $2x^2 = 576$
 $x^2 = 288$
 $x = \sqrt{288} \approx \mathbf{16.97\text{ inches}}$ (The calculator answer is 16.97056275. Any correct rounding of this number up to 17 inches is considered correct.)

Part 3: Area of foil in inches: $\left(1\frac{1}{4}\right)\left(1\frac{1}{4}\right)(144) = 225\text{ in}^2$, {or, since $1\frac{1}{4}\text{ ft} = 15\text{ inches}$, $15 \times 15 = 225$ }
 Area of square cooking surface: $(16.97)(16.97) = 287.98\text{ in}^2$ (The answer may be in the range of $287.98 - 289$, depending on what rounded value the student uses for the length of the side of the square rack.) **The foil will not cover the surface.** ($225\text{ in}^2 < 287.98\text{ in}^2$)

Note: Units are required for the final answer in parts 1 and 2, and in part 3 where appropriate, for a score of 4. If correct units are not shown for all parts, the response cannot receive a score of 4. However, do not penalize for missing or incorrect units at any scorepoint below a 4.

No credit is given to a conclusion in part 3 with no or obviously incorrect support.

ALGEBRA I OPEN-RESPONSE ITEM C

- C. Tanya's Jewelry Shop sells several types of rings and earrings. The number of items Tanya orders for January is represented in the matrix below.

		January Order			
		Silver	Gold	Pearl	
Rings	[32	45	40]
Earrings	[50	42	60]

1. In February, Tanya decides to order 60% of her January order. Write a matrix that represents her February order. Be sure to include a title as well as labels for each row and each column. Show all of your work even if you use mental math or a calculator.
2. In March, Tanya decides to order $\frac{5}{4}$ of her January order. Write a matrix to represent her March order. Be sure to include a title as well as labels for each row and each column. Show all of your work even if you use mental math or a calculator.
3. Using the matrices above, determine Tanya's total orders for the quarter (January, February, and March). For your final matrix, be sure to include a title as well as labels for each row and each column. Show all of your work even if you use mental math or a calculator.

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

RUBRIC FOR ALGEBRA I OPEN-RESPONSE ITEM C

SCORE	DESCRIPTION
4	All three parts are correct with all work shown (including complete labeling).
3	All three parts are correct with some work shown (labeling may be incomplete). OR Correct matrix format in all three parts, but labeling may not be complete and/or some values may be incorrect due to calculation error(s), with most work shown for finding the number of rings and earrings ordered.
2	Correct matrix format (labels no longer an issue) in all three parts with some evidence of correct procedures in each part for finding the number of rings and earrings ordered. Some values may be incorrect due to calculation error(s). OR Correct matrix format (labels no longer an issue) in all three parts, but one matrix contains incorrect entries due to a procedural error with most work shown in the other two parts. Some values may be incorrect due to calculation error(s). OR All correct values, not presented in matrix format, but are presented in an organized form (e.g., a table) with some work shown. OR All correct values in correct matrix format (labels no longer an issue) with no work shown.
1	One part correct with or without work shown. OR Student shows minimal understanding of performing the operations of addition and/or scalar multiplication.
0	No understanding. Work is either incorrect or irrelevant.
Blank	No response.

- Note:**
- Answers not rounded are considered correct below a score of 4. When rounding, the student may round either up or down.
 - The answer to part 3 is dependent upon parts 1 and 2, and should be considered correct if derived correctly based on incorrect answers to parts 1 and/or 2.

Sample Solution:

Part 1:

February Order

	Silver	Gold	Pearl
Rings	19	27	24
Earrings	30	25	36

	Rings	Earrings
Silver:	$.6(32) = 19.2$	$.6(50) = 30$
Gold:	$.6(45) = 27$	$.6(42) = 25.2$
Pearl:	$.6(40) = 24$	$.6(60) = 36$

Part 2:

March Order

	Silver	Gold	Pearl
Rings	40	56	50
Earrings	63	53	75

	Rings	Earrings
Silver:	$1.25(32) = 40$	$1.25(50) = 62.5$
Gold:	$1.25(45) = 56.25$	$1.25(42) = 52.5$
Pearl:	$1.25(40) = 50$	$1.25(60) = 75$

Part 3:

Total Order for the Quarter

	Silver	Gold	Pearl
Rings	91	128	114
Earrings	143	120	171

	Rings	Earrings
Silver:	$32 + 19 + 40 = 91$	$50 + 30 + 63 = 143$
Gold:	$45 + 27 + 56 = 128$	$42 + 25 + 53 = 120$
Pearl:	$40 + 24 + 50 = 114$	$60 + 36 + 75 = 171$

ALGEBRA I OPEN-RESPONSE ITEM D

- D. Mammoth Spring is one of the nation’s largest springs. Water flows from it at a rate of about 9.78 million gallons per hour.
1. Determine how many gallons of water flow from the spring in one minute. Express your answer in scientific notation. Show or explain your work even if you use mental math or a calculator.
 2. Determine how many gallons of water flow from the spring in one year. (One year \approx 365 days.) Express your answer in scientific notation. Show or explain your work even if you use mental math or a calculator.
 3. At Hot Springs Mountain, the springs have a total daily flow of about 850,000 gallons. How much more water flows **daily** from Mammoth Spring than from the springs at Hot Springs Mountain? Express your answer in scientific notation. Show or explain your work even if you use mental math or a calculator.

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

RUBRIC FOR ALGEBRA I OPEN-RESPONSE ITEM D

SCORE	DESCRIPTION
4	The student earns 6 points.
3	The student earns 5 points.
2	The student earns 3 – 4 points.
1	The student earns 1 – 2 points. OR The response demonstrates minimal understanding of solving problems involving scientific notation.
0	No understanding. Work is either incorrect or irrelevant.
Blank	No response.

Score Point Description:

- Part 1:** Score **2 points** for correct answer in scientific notation, with work shown or an explanation provided.
OR
Score **1 point** for correct answer in scientific notation, with no or incomplete work shown or explained;
or for correct procedure shown with an incorrect answer due either to calculation errors or answer not expressed correctly in scientific notation.
- Part 2:** Score **2 points** for correct answer in scientific notation, with work shown or an explanation provided.
OR
Score **1 point** for correct answer in scientific notation, with no or incomplete work shown or explained;
or for correct procedure shown with an incorrect answer due either to calculation errors or answer not expressed correctly in scientific notation.
- Part 3:** Score **2 points** for correct answer in scientific notation, with work shown or an explanation provided.
OR
Score **1 point** for correct answer in scientific notation, with no or incomplete work shown or explained;
or for correct procedure shown with an incorrect answer due either to calculation errors or answer not expressed correctly in scientific notation.

Sample Solution:

Part 1: 9.78 million = 9,780,000
9,780,000 gallons per hour / 60 minutes per hour = 163,000 gallons per minute
163,000 = 1.63×10^5 (gallons per minute)

Part 2: 365 days a year \times 24 hours a day = 8,760 hours in a year
9,780,000 \times 8,760 = 85,672,800,000 gallons per year =
 8.56728×10^{10} (gallons per year)

Part 3: Mammoth Spring daily water flow:
9,780,000 gallons per hour \times 24 hours = 234,720,000 gallons per day
Difference between daily water flow of Mammoth Spring and Hot Springs Mountain:
234,720,000 – 850,000 = 233,870,000 gallons = 2.3387×10^8

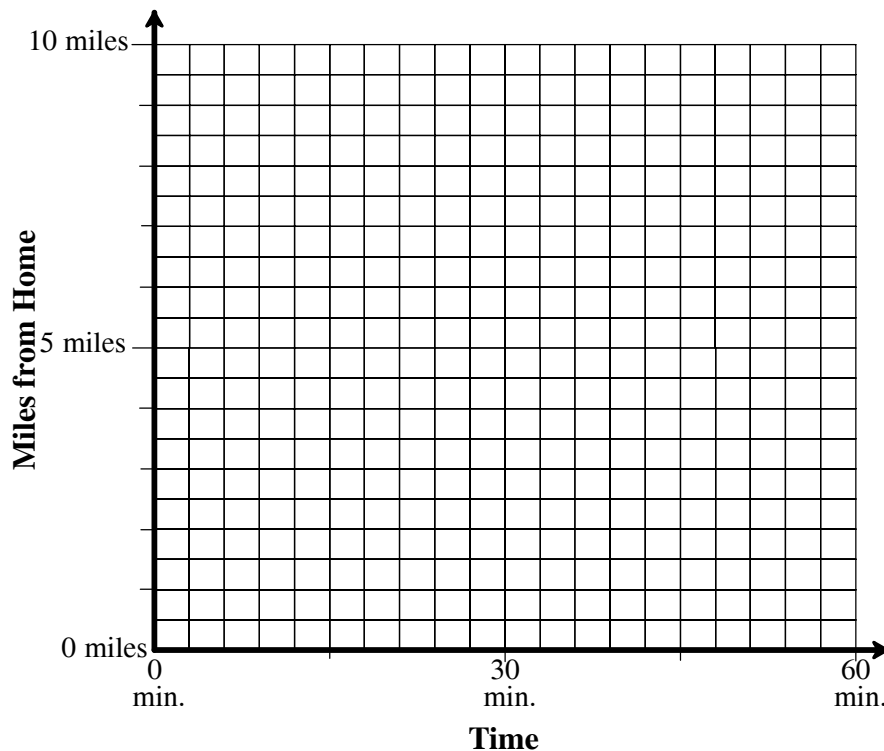
Note: Correct units/labels are not required at any score point level. However, do not score a 4 for responses that contain incorrect units/labels, but do not penalize for incorrect units/labels at any score point below a 4.

ALGEBRA I OPEN-RESPONSE ITEM F

F. To demonstrate to her algebra class that information can be represented as a graph, Kirsten recorded data as she rode in the car with her mother. She recorded the distance and the time for several portions of a trip. The car traveled at a constant rate of speed. She found:

- After starting, they rode for 6 minutes until reaching the grocery store that was 4 miles from home.
- They stopped and spent 12 minutes in the store.
- After returning to the car, they traveled 12 more minutes until they reached the gas station. The gas station was 6 miles farther from home than the grocery store.
- They spent 6 minutes putting gas into the car.
- After leaving the gas station, they headed home. They rode for 9 minutes and traveled 5 miles toward home before stopping at the post office.
- They spent 3 minutes mailing a letter at the post office.
- After leaving the post office, Kirsten and her mother traveled 6 more minutes before arriving home.

Carefully copy the coordinate axes below onto the grid in your Student Answer Document. Be certain to include the units on each axis. On the coordinate system, draw a line graph to represent the trip. Clearly label the graph by writing the location of Kirsten and her mother (home, grocery store, gas station, post office) used to represent each portion of the trip on or near the correct section of the graph.

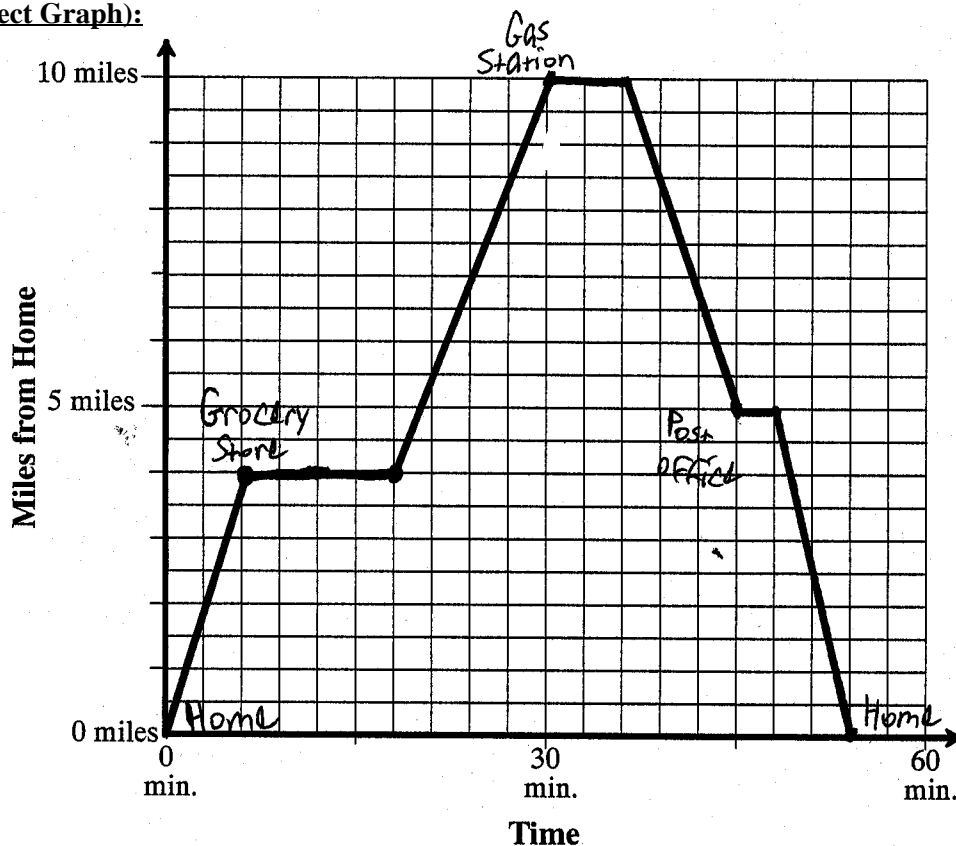


RUBRIC FOR ALGEBRA I OPEN-RESPONSE ITEM F

SCORE	DESCRIPTION
4	The student draws a line graph that correctly represents all segments of the trip. All locations are correctly and clearly labeled on the graph.
3	The student draws a line graph that correctly represents most segments of the trip (5 to 6). (Labeling may be incomplete or omitted.)
2	The student draws a line graph that correctly represents only half (3 to 4) of the segments of the trip. The other segments of the graph are either omitted or are incorrect due to major errors (errors in scaling, does not represent a constant rate of speed).
1	The student draws a line graph that correctly represents only one or two segments of the trip. OR The response demonstrates minimal understanding of communicating graphically real-world problems.
0	No understanding. Work is either incorrect or irrelevant.
Blank	No response.

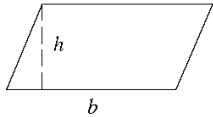
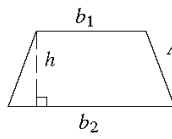
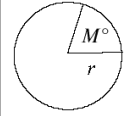
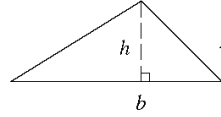
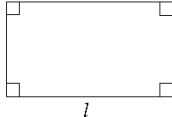
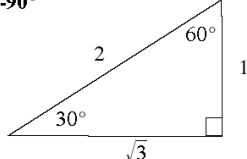
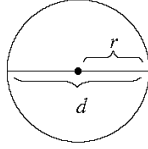
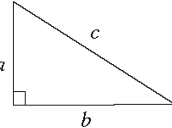
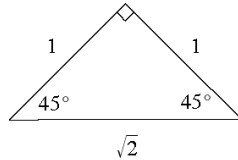
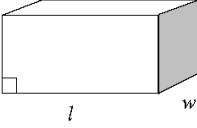
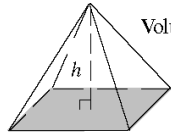
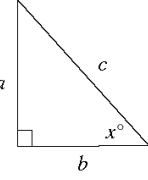
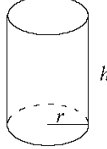
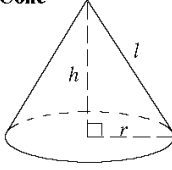
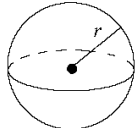
Note: If a student uses a consistent scale other than the given scale, this is a 3 / 4 issue only.

Solution (Correct Graph):



End of Course Mathematics Reference Sheet

This reference sheet was used in 2004 testing. Changes or additions may occur in future testing.

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

Miscellaneous Formulas	Area of an equilateral triangle	$A = \frac{s^2\sqrt{3}}{4}$ $s = \text{length of a side}$
	Distance	rate • time
	Interest	principal • rate • 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 $m = \text{slope}$, $b = \text{intercept}$)	$y = mx + b$
	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	$A = \frac{1}{2}ap$ $a = \text{apothem}$, $p = \text{perimeter}$	

The Arkansas Mathematics Framework *

Patterns, Algebra & Functions Strand

Algebra I Course Goals

Content Standards/Goals	Student Learning Expectations
1. Language of Algebra	<ol style="list-style-type: none"> 1. Real number system: Recognize and use counting numbers, whole numbers, integers, rational numbers, and irrational numbers. 2. Know the fundamental language of algebra (e.g., sum, difference, product, quotient, factor, term, prime, composite, exponent, root, etc.). 3. Demonstrate ability to use the order of operations. 4. Understand the concept of variable as used in algebraic modeling. 5. Translate word expressions to symbolic expressions. 6. Distinguish between “expression,” “equation,” “simplify,” & “solve.” 7. Illustrate numerically and recognize: the meaning of powers and roots, basic algebraic properties (commutative, associative, distributive, reflexive), absolute value, and concept of inequality.
2. Solve Equations & Inequalities	<ol style="list-style-type: none"> 1. Solve equations involving: integers and fractions, ratios and proportions, simple absolute value, real-world applications ($d = rt$, percents, simple probability, etc.), and open-ended questions. 2. Solve simple inequalities. 3. Express answers using: estimation, appropriate units, and sentence form. 4. Integrate algebra and geometry in problems involving: student sketches of basic geometric shapes (square, rectangle, triangle, circle), formulas (Pythagorean Theorem, area, perimeter), and representation of 1- and 2-dimensional figures algebraically.
3. Graphs and Tables (with and without graphing calculators)	<ol style="list-style-type: none"> 1. Read, construct, and interpret graphs and tables. Use the results to make predictions. 2. Use a simple matrix to represent data and perform the operations of addition, subtraction, and scalar multiplication. 3. Use and apply linear functions to model: slope/rate of change, intersection of lines graphically and algebraically, equations of the form $Ax + By = C$ and $y = mx + b$, the equation for the line of best fit, and real-life situations (meaning of slope/y-intercept, predictions). 4. Calculate measures of central tendency (e.g., determine mean, median, mode; and represent data by stem-and-leaf, box and whisker, and histogram).
4. Functions, Relations, & Patterns	<ol style="list-style-type: none"> 1. Use function notation. 2. Identify the domain and range of a relation (from ordered pairs or graphs). 3. Determine if a given relation is a function (from ordered pairs or graphs). 4. Find the zeros of a function by examining a graph. 5. Identify independent and dependent variable in a real-life situation. 6. Communicate graphically, algebraically, and verbally real-world problems.
5. Polynomial Operations	<ol style="list-style-type: none"> 1. Add, subtract, and multiply polynomials (combining similar terms). 2. Factor simple expressions. 3. Solve second degree equations by factoring and graphing. 4. Solve problems involving scientific notation.

*The Content Standards/Goals and Student Learning Expectations listed are those that specifically relate to the released test items in this document.

PART V Item Correlation with Curriculum Framework

Released Items for Algebra I *

Item	Content Standard/Goals	Expectation
1	1	3
2	3	4
3	2	4
4	3	1
5	4	1
6	5	4
7	1	1
8	2	1
9	3	2
10	4	2
11	1	5
12	5	3
13	2	3
14	3	3
15	4	3
16	5	2
17	1	6
18	2	2
19	4	5
20	5	3
21	2	1
22	1	2
23	3	3
24	4	1
25	5	4
26	1	3
27	2	4
28	3	1
29	4	3
30	5	2
31	1	5
32	2	1
33	3	4

Item	Content Standard/Goals	Expectation
34	4	4
35	5	3
36	1	6
37	2	4
38	3	3
39	4	6
40	5	1
41	1	2
42	2	1
43	3	4
44	4	2
45	5	1
46	1	4
47	2	4
48	2	4
49	1	7
50	3	3
51	5	2
52	1	5
53	2	2
54	4	3
55	3	2
56	4	6
57	3	4
58	4	4
59	5	1
60	5	4
A	1	5
B	2	4
C	3	2
D	5	4
F	4	6

*Only the predominant Content Standard/Goals and learning expectation is listed for the Algebra I items.

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