



Arkansas
Comprehensive Testing, Assessment
& Accountability Program

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

January 2005 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 first semester participated in the *Algebra I Midyear End of Course Examination* in January of 2005.

This *Released Item Booklet* for the *Algebra I Midyear End of Course Examination* contains test questions or items that were asked of students during the January 2005 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 January of 2005. 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 34 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 Midyear 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 Midyear 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 Midyear End of Course Examination* items align or correlate with the *Arkansas Mathematics Curriculum Framework* to provide models for classroom instruction.

1. Which is an equation?

- * A. $3x^2 + 7x = -4$
- B. $6x + 8y$
- C. $7x + 5x - 5 - 18 < 5$
- D. $7(x + 3) - 2(x - 5)$

2. The ticket sales for a community play totaled \$2,250. The cost was \$8 for adults and \$5 for youths. There were 4 times as many youth tickets sold as adult tickets sold. Which algebraic sentence could be used to determine how many tickets of each type were sold?

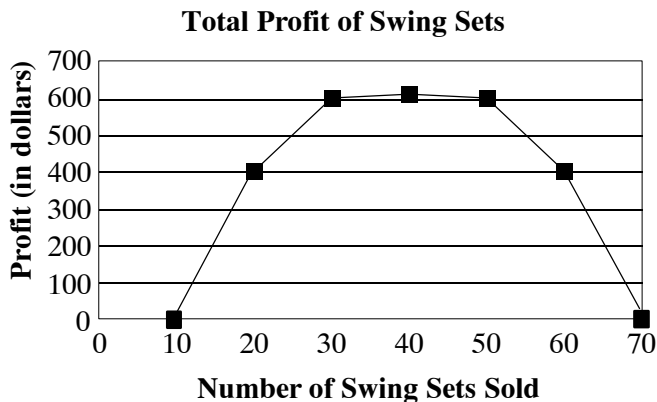
- * A. $2,250 = 8x + 5(4x)$
- B. $2,250 = 8(4x) + 5x$
- C. $2,250 = (8)(5)(4x)$
- D. $2,250 = 4x(8x + 5x)$

Use the chart below to answer question 3.

Sport	1990–1991 Season	2000–2001 Season
Hockey	\$271,000	\$1.4 million
Basketball	\$823,000	\$3.5 million
Baseball	\$597,537	\$2.26 million
Football	\$430,000	\$1.2 million

3. The average salaries of 4 major sports are shown above for the years 1990–1991 and 2000–2001. Which statement is correct when describing the data?
- A. For both seasons, the average hockey salary was the lowest.
 - B. Baseball had the largest increase from the 1990–1991 season to the 2000–2001 season.
 - * C. For both seasons, the average basketball salary was the highest.
 - D. For both seasons, the average football salary was the lowest.

Use the graph below to answer question 4.



4. The graph above shows the total profit of swing sets sold. What are the zeros of the graph?
- A. (0, 0) and (70, 700)
 * B. (10, 0) and (70, 0)
 C. (20, 400) and (60, 400)
 D. (40, 625) and (50, 600)
5. Sound travels through air at about 8.7×10^{-5} times the speed of light. Which is another way to represent 8.7×10^{-5} ?
- A. 0.0000087
 * B. 0.000087
 C. 870,000
 D. 8,700,000
6. Bill had a piece of lumber x feet long. He cut a new length of lumber 2 feet longer than one-third of the original length of lumber. Which expression represents the length of the new piece of lumber?
- * A. $\frac{1}{3}x + 2$
 B. $\frac{1}{3}(x + 2)$
 C. $3x + 2$
 D. $3(x + 2)$
7. Ellen bought beef and pork. She bought $7\frac{1}{2}$ pounds of beef and $5\frac{1}{4}$ pounds of pork. The beef cost \$3 per pound. The total bill was \$33.00. What was the cost of the pork per pound?
- A. \$0.27
 B. \$1.00
 * C. \$2.00
 D. \$5.57

Use the table below to answer question 8.

Scott's Crop Report

Fertilizer	0	1	2	3	4	5	6	7	8
Corn yield	58	60	59	61	63	66	65	67	70

8. Scott is a farmer and grows corn. He records the number of pounds of fertilizer he uses and the corn yield (in bushels). Which is a correct statement representing Scott's data?
- A. Each pound of fertilizer yields 60 bushels of corn.
 - B. The corn yield generally decreases as the fertilizer increases.
 - C. If Scott uses 2.5 pounds of fertilizer, he will grow 60 bushels of corn.
 - * D. The corn yield generally increases as the fertilizer increases.

9. Mark earns \$40,000 per year and receives a raise of \$1,000 per year. Which equation represents his income level after t years?

- A. $I = (1,000 + t) + 40,000$
- B. $I = 1,000(40,000 + t)$
- * C. $I = 1,000t + 40,000$
- D. $I = 40,000t + 1,000$

10. Completely factor:

$$x^2 + 3x - 10$$

- * A. $(x - 2)(x + 5)$
- B. $(x - 1)(x + 10)$
- C. $(x + 1)(x - 10)$
- D. $(x + 2)(x - 5)$

11. A parking lot has 31 spaces for cars. Which type of numbers best represent the possible number of cars in the parking lot?

- A. integers
- B. rationals
- C. reals
- * D. counting

12. William found an equation to calculate the number of diagonals (D) in a polygon with n sides:

$$D = \frac{n(n - 3)}{2}$$

A polygon with 54 diagonals has how many sides?

- A. 9
- * B. 12
- C. 27
- D. 30

Use the matrix below to answer question 13.

$$\begin{array}{c} \\ \end{array} \begin{array}{ccc} A & B & C \\ \left[\begin{array}{ccc} -3 & 2 & 0 \\ 2 & 1 & -5 \end{array} \right] \end{array}$$

13. The matrix above represents three points that form a triangle when graphed. When the matrix above is multiplied by the scalar 3, what is the result?

A.
$$\begin{array}{c} \\ \end{array} \begin{array}{ccc} A & B & C \\ \left[\begin{array}{ccc} 0 & 5 & 3 \\ 5 & 4 & -2 \end{array} \right]$$

* B.
$$\begin{array}{c} \\ \end{array} \begin{array}{ccc} A & B & C \\ \left[\begin{array}{ccc} -9 & 6 & 0 \\ 6 & 3 & -15 \end{array} \right]$$

C.
$$\begin{array}{c} \\ \end{array} \begin{array}{ccc} A & B & C \\ \left[\begin{array}{ccc} -6 & -1 & -3 \\ -1 & -2 & -8 \end{array} \right]$$

D.
$$\begin{array}{c} \\ \end{array} \begin{array}{ccc} A & B & C \\ \left[\begin{array}{ccc} -1 & \frac{2}{3} & 0 \\ \frac{2}{3} & \frac{1}{3} & -\frac{5}{3} \end{array} \right]$$

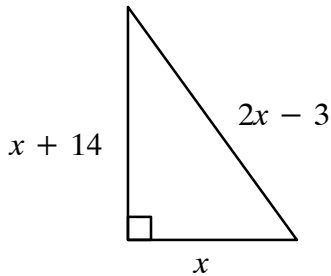
14. Which set represents a function?

- A. $\{(1, 1), (1, 2), (1, 3)\}$
- B. $\{(0, 2), (2, 4), (2, 6)\}$
- C. $\{(0, 0), (1, 0), (0, 1)\}$
- * D. $\{(1, 0), (2, 1), (3, 1)\}$

15. The mass of 1 hydrogen atom is 1.67×10^{-24} grams. What is the approximate mass of 60,000 hydrogen atoms?

- A. 2.783×10^{-29} grams
- B. 2.783×10^{-27} grams
- C. 1.002×10^{-21} grams
- * D. 1.002×10^{-19} grams

Use the figure below to answer question 16.



16. Jeff has an entertainment center with a triangular base, as shown above. What is the perimeter of the entertainment center's base?
- * A. $4x + 11$
 - B. $4x + 17$
 - C. $2x^3 + 11$
 - D. $2x^3 + 17$
17. When $x = -3$, what is the value of $5x^2$?
- A. -45
 - B. -30
 - * C. 45
 - D. 225
18. Carolyn printed her history paper. The printer operated at a speed of 3 pages per minute. How many minutes did it take to print half of a 12-page paper?
- * A. 2
 - B. 4
 - C. 6
 - D. 9

Use the information below to answer question 19.

- \$129,900 \$219,500
- \$129,900 \$264,900
- \$157,900 \$264,900
- \$159,500 \$264,900
- \$165,900 \$285,000

19. Bryan kept track of the sales of 10 townhouses as shown above. What is the mode of the sales for the townhouses Bryan tracked?
- A. \$129,900
 - B. \$192,700
 - C. \$204,230
 - * D. \$264,900
20. Which equation is written using function notation?
- A. $y = mx + b$
 - * B. $f(x) = 5x + 7$
 - C. $f = 3$
 - D. $2(3x) = 7$

21. Bill's Bait Shop has a monthly operating cost (C) of $C = 2(x - 15)^2 - (2x - 7)$, where x is the number of days the shop is open each month. Bill's shop was open for 25 days last month. What was Bill's operating cost that month?

- A. \$143
- * B. \$157
- C. \$357
- D. \$364

22. Jeremy has $2\frac{3}{4}$ cups of plaster. He needs $5\frac{1}{2}$ cups of plaster to fill the mold he is using. Jeremy can solve the equation $2\frac{3}{4} + x = 5\frac{1}{2}$ to determine how much more plaster is needed. How many more cups of plaster does Jeremy need?

- A. $2\frac{1}{2}$
- * B. $2\frac{3}{4}$
- C. $3\frac{1}{4}$
- D. $8\frac{1}{4}$

Use the data below to answer question 23.

Student heights (inches):
62, 66, 67, 69, 73, 73, 80

23. Which is true of the data set above?

- * A. The mode is larger than the median.
- B. The mode and median have the same value.
- C. There is no mode.
- D. The median is larger than the mode.

Use the table below to answer question 24.

Kyle's Electric Bills

Total Cost	Energy Used (kWh)
\$107	1,352
\$125	1,563
\$93	1,163
\$102	1,275

24. Kyle's 4 most recent electric bills are shown in the table above. What is the independent variable in this situation?

- A. number of bills
- B. total cost
- C. cost per unit of energy used
- * D. energy used

25. Human blood cells measure 0.00076 mm in diameter. What is this value written in scientific notation?

- A. 7.6×10^{-5} mm
- * B. 7.6×10^{-4} mm
- C. 7.6×10^3 mm
- D. 7.6×10^4 mm

26. A photographer charges \$2.50 for developing one roll of film plus \$0.75 for each panoramic picture. Which expression represents the total cost of developing one roll of film with p panoramic pictures?

- A. $\$2.50p + \0.75
- B. $\$2.50p - \0.75
- * C. $\$2.50 + \$0.75p$
- D. $p(\$2.50 + \$0.75)$

27. A furniture store has tables (t) and chairs (c) stored in boxes. One box can hold either 2 chairs or 1 table. This situation is represented by the equation below:

$$\text{Number of boxes} = \frac{c}{2} + t$$

The store has 480 chairs and 128 tables. How many boxes does the furniture store have?

- A. 304
- * B. 368
- C. 544
- D. 1,088

Use the matrix below to answer question 28.

	Hardware	Software
Computer	18	9
Printer	11	4

28. Carl's Computer Company uses a matrix to keep record of computer parts inventory. The inventory on October 1st is listed in the matrix above. By November 30th, the company wanted to triple the inventory. Which matrix represents the tripled inventory?

A.

	Hardware	Software
Computer	15	6
Printer	8	1

B.

	Hardware	Software
Computer	21	12
Printer	14	7

C.

	Hardware	Software
Computer	36	18
Printer	22	8

* D.

	Hardware	Software
Computer	54	27
Printer	33	12

Use the table below to answer question 29.

Cedar (Age, Height)	Aspen (Age, Height)	Pine (Age, Height)	Oak (Age, Height)
(1, 1)	(1, 1.5)	(2, 1)	(3, 3)
(1, 1.5)	(2, 3)	(2, 2)	(3, 2)
(2, 2.5)	(3, 4)	(4, 3.5)	(5, 5)

29. James is studying 4 types of trees. He recorded the age (in years) and height (in feet) of 3 trees from each tree type, shown above. Which tree type represents a function?
- A. Cedar
 - * B. Aspen
 - C. Pine
 - D. Oak

30. The mass of one electron is 9.28×10^{-28} grams. One atom of radium has 88 electrons. What is the approximate mass of electrons in one atom of radium expressed in scientific notation?
- A. 8.17×10^{-30}
 - B. 8.17×10^{-28}
 - * C. 8.17×10^{-26}
 - D. 8.17×10^2

Use the equations below to answer question 31.

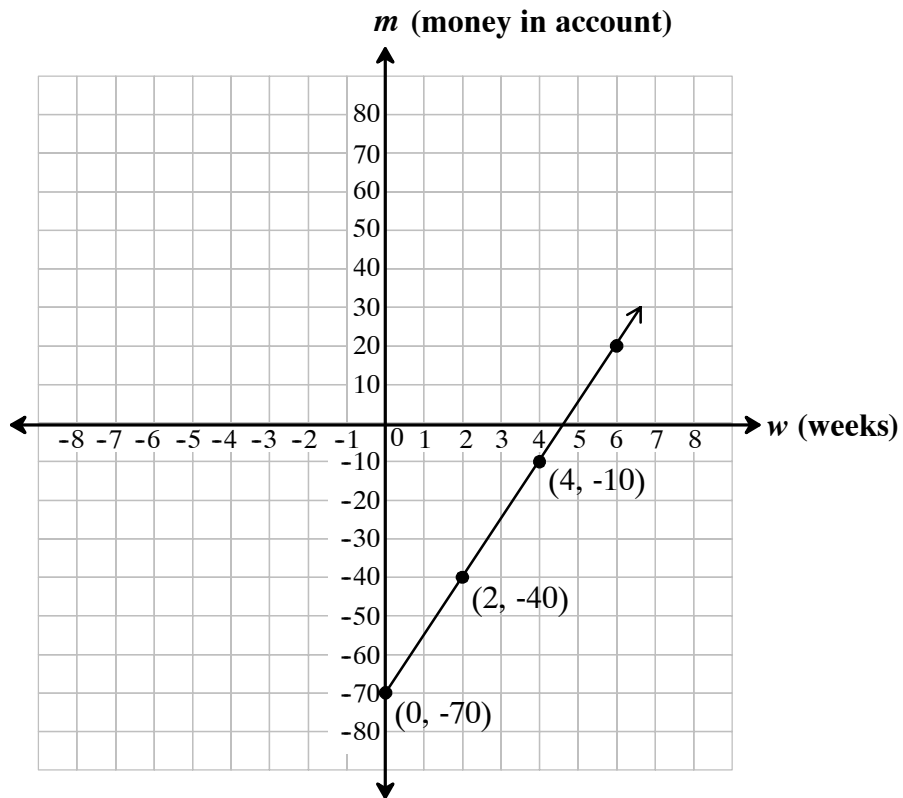
$$y = mx + b$$

$$3x = 9$$

$$n = 1 + t^2$$

31. Which describes the **letters** in the equations above?
- A. domains
 - B. exponents
 - C. products
 - * D. variables

Use the graph below to answer question 32.



32. Markus owes his parents \$70. He saved \$30 every 2 weeks. How much money will he have after 10 weeks and after paying his parents \$70?
- * A. \$80
 - B. \$150
 - C. \$220
 - D. \$230

33. A student put together a data set of approximate related temperatures in the Fahrenheit and Celsius scales:

$$\{(0, -18), (32, 0), (70, 21), (100, 38), (212, 100)\}$$

What is the domain of this relation?

- A. 118
 B. 212
 C. $\{-18, 0, 21, 38, 100\}$
 * D. $\{0, 32, 70, 100, 212\}$
34. Solve:
- $$4x - 15 < 9$$
- A. $x \leq -\frac{3}{2}$
 B. $x \geq \frac{3}{2}$
 * C. $x < 6$
 D. $x < 96$
35. The length of a flu virus cell is 1.0×10^{-7} meters. What is the length of the flu virus cell in standard notation?
- * A. 0.0000001 meters
 B. 0.000001 meters
 C. 1,000,000 meters
 D. 10,000,000 meters

Use the function below to answer question 36.

$$S(h) = 1,116 - 4.04h$$

36. The function above approximates the speed of sound (in feet per second) at an altitude of h (in thousands of feet). To the nearest whole number, what is the value of S at an altitude of 10,000 feet ($h = 10$)?
- A. 111 feet per second
 B. 274 feet per second
 * C. 1,076 feet per second
 D. 2,199 feet per second
37. What is the greatest common factor of $3ax^3$ and $9a^2x^2$?
- A. $3ax$
 * B. $3ax^2$
 C. $6ax$
 D. $9a^2x^3$

Use the table below to answer question 38.

# of Tickets Sold	Total Cost for the Group
1	\$7.50
2	\$15.00
3	\$22.50
4	\$30.00
5	\$37.50

38. Joleen worked at a movie theater. She kept a list by the cash register to determine how much to charge groups of n people for tickets. Which expression represents the total cost for a group of n people?

- A. $5n + 37.50$
- B. $7.50 + n$
- C. $7.50 + 5n$
- * D. $7.50n$

39. Shawn has a collection of 50 stamps worth \$18.30. Some stamps are worth 37 cents each and the rest of the stamps are worth 25 cents each. Which algebraic sentence could Shawn use to determine how many stamps he has of each type?

- * A. $0.37x + 0.25(50 - x) = 18.30$
- B. $0.37x + 0.25(x - 50) = 18.30$
- C. $(0.37 + 0.25) + (50 - x) = 18.30$
- D. $(0.37 + 0.25) + (x - 50) = 18.30$

PART II Released Multiple-Choice Items — Algebra I

Use the matrix below to answer question 40.

	Price A	Price B	Price C
Kites	22	10	12
Windssocks	21	3	10

40. The Wind Shop carries kites and windssocks that sell in 3 price ranges. Their present inventory is represented in the matrix above.

In April, the store adds 6 kites that sell for price A, 4 kites for price B, and 2 kites for price C to the shelves. Also, the windssock inventory is doubled. Which matrix represents the new inventory at the Wind Shop?

A.

	Price A	Price B	Price C
Kites	44	20	24
Windssocks	42	6	20

B.

	Price A	Price B	Price C
Kites	44	20	24
Windssocks	27	7	12

C.

	Price A	Price B	Price C
Kites	28	14	14
Windssocks	27	7	12

* D.

	Price A	Price B	Price C
Kites	28	14	14
Windssocks	42	6	20

41. Which algebraic statement can be solved?
- A. $-3(x - 5) - 2(x + 1)$
 - B. $3x + 2x - 6x$
 - * C. $4(x - 2) - 3(x + 1) = 11$
 - D. $6x - 1$
42. A train travels 125 miles per hour. How many hours will it take the train to travel 3,000 miles?
- A. 0.04
 - B. 2.4
 - C. 4
 - * D. 24
43. The function $f(x) = 70 + 5x$ represents the amount of money Jenny has in her bank account after x weeks. How much money does she have in the bank account after 8 weeks?
- A. \$40
 - * B. \$110
 - C. \$128
 - D. \$600
44. Factor:
- $$x^2 + 3x + 2$$
- A. $6x^3$
 - * B. $(x + 2)(x + 1)$
 - C. $(x - 2)(x - 1)$
 - D. $(x - 2)(x + 1)$

PART II Released Multiple-Choice Items — Algebra I

Use the matrices below to answer question 45.

	Sweatpants		Sweatshirts
Small	$\begin{bmatrix} 9 \end{bmatrix}$		Small $\begin{bmatrix} 12 \end{bmatrix}$
Medium	$\begin{bmatrix} 15 \end{bmatrix}$		Medium $\begin{bmatrix} 19 \end{bmatrix}$
Large	$\begin{bmatrix} 22 \end{bmatrix}$		Large $\begin{bmatrix} 28 \end{bmatrix}$
X-Large	$\begin{bmatrix} 13 \end{bmatrix}$		X-Large $\begin{bmatrix} 20 \end{bmatrix}$

45. A store carries sweatpants and sweatshirts. The store keeps track of inventory using two separate matrices as shown above. The store has combined the sweatshirts and sweatpants to make outfits. Which matrix shows how many sweatshirts were left over after all the outfits were made?

* A. $\begin{bmatrix} 3 \\ 4 \\ 6 \\ 7 \end{bmatrix}$

B. $\begin{bmatrix} 21 \\ 34 \\ 50 \\ 33 \end{bmatrix}$

C. $\begin{bmatrix} 9 & 12 \\ 15 & 19 \\ 22 & 28 \\ 13 & 20 \end{bmatrix}$

D. $\begin{bmatrix} 9 & 15 & 22 & 13 \\ 12 & 19 & 28 & 20 \end{bmatrix}$

46. A computer program can sort a list of n items in order after going through the list $n(n - 1)$ times. This is equivalent to $n \cdot n - n$. Which algebraic property is demonstrated?

- A. associative
- B. commutative
- * C. distributive
- D. reflexive

47. Nita is shopping for school clothes. She has a total of \$45.00 to spend. She has already purchased a shirt for \$12.50 and pair of pants for \$15.00. What is the most she can pay for other items and stay within her total?

- * A. \$17.50
- B. \$27.50
- C. \$30.00
- D. \$32.50

48. Jamie's dad records his mileage each time he fills his car with gas. The number of miles he traveled on 7 full tanks of gas is listed below.

220, 196, 205, 165, 220, 180, 190

What is the mean to the nearest whole mile?

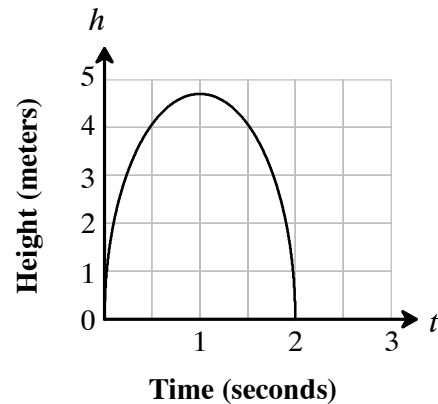
- A. 165
- B. 196
- * C. 197
- D. 220

Use the equation below to answer question 49.

$$f(x) = x^2 + x + 1$$

49. What is $f(3)$?
- A. 7
 - B. 9
 - C. 10
 - * D. 13

Use the graph below to answer question 50.



50. Brent kicked a football. The graph above shows the height of the football, h , at time t . When was the football at a height of zero?
- A. $\frac{1}{2}$ second
 - B. 1 second
 - C. $1\frac{1}{2}$ seconds
 - * D. 2 seconds

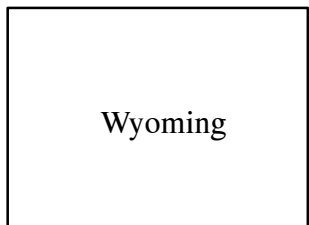
Use the table below to answer question 51.

City	Temperature
Chicago	-2°F
Des Moines	-12°F
Denver	20°F
Houston	34°F
New Orleans	34°F

51. The table above lists the low temperatures for one day in January for some U.S. cities. What type of number are the temperatures listed?
- * A. integers
 - B. irrational
 - C. whole
 - D. counting

Use the figure below to answer question 52.

$l = \text{length}$



52. The state of Wyoming is in the shape of a rectangle. The perimeter of Wyoming is 1,280 miles. The width of the state is 90 miles less than the length. What is the length of Wyoming?
- A. 275 miles
 - B. 297.5 miles
 - C. 342.5 miles
 - * D. 365 miles

53. Margie is choosing a caterer for her graduation party. Jeff's Catering charges \$11 per guest. Sarah's Dinner Service charges a set-up fee of \$80 plus \$7 per guest. How many guests would Margie have to invite for the catering costs to be the same for each company?

- A. 4
- B. 10
- C. 13
- * D. 20

54. The cheerleaders held a car wash to raise money. They started with \$80 in their account and earned \$3 per car washed (c). Which equation reflects the new balance (b) in their account?

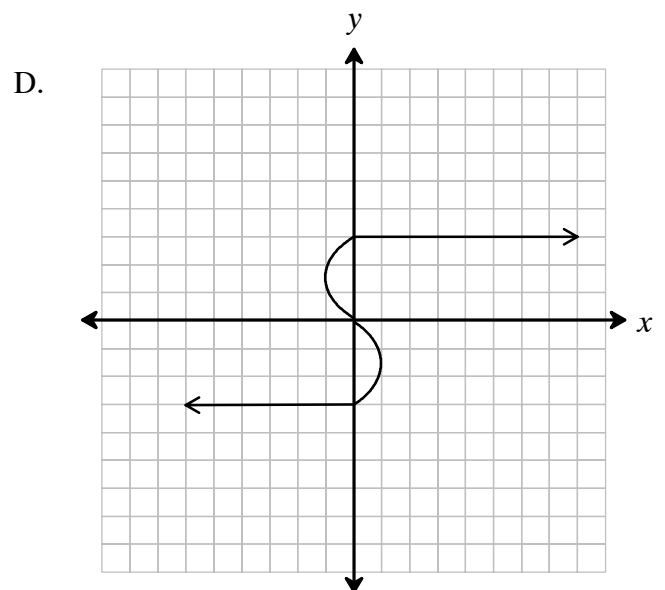
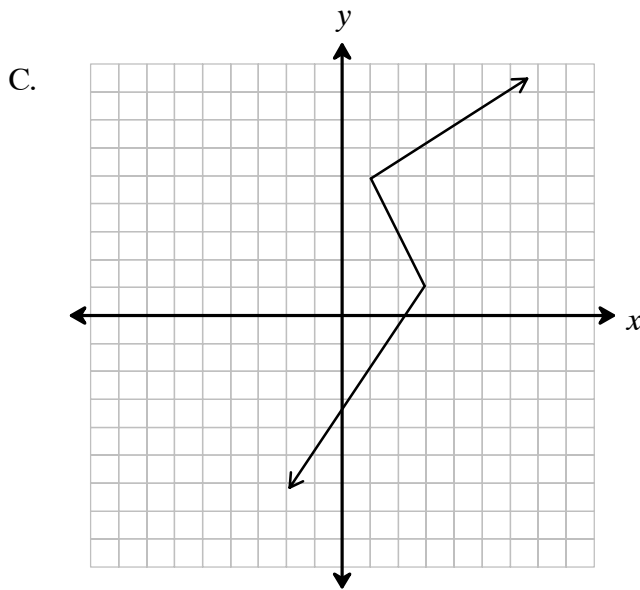
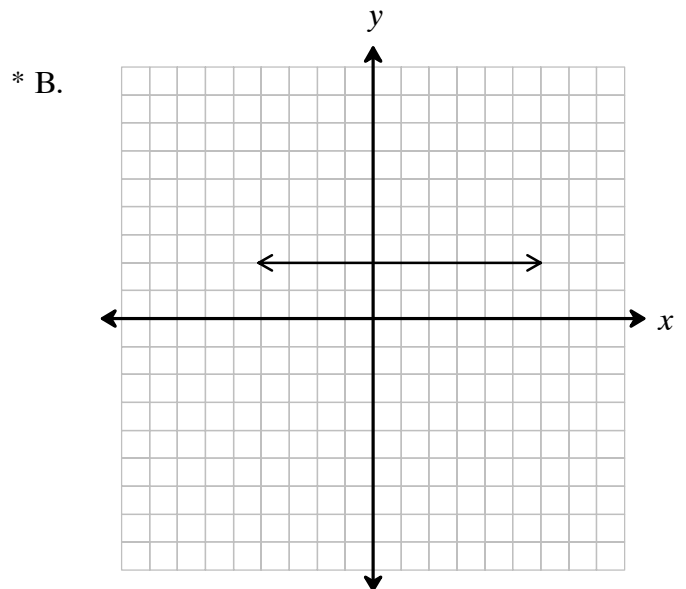
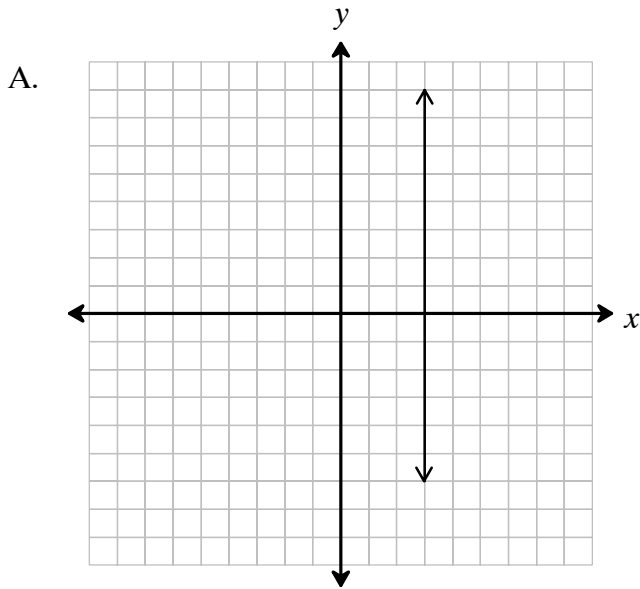
- A. $b + 3c = 80$
- * B. $b = 3c + 80$
- C. $3b = c + 80$
- D. $c = 80 - 3b$

55. Completely factor:

$$a^3b^2 - a^2b^3$$

- * A. $a^2b^2(a - b)$
- B. $a^2b^2(a^2 - b)$
- C. $a^2b^3(a - 1)$
- D. $a^3b^3(a - 1)$

56. Which graph is a function?



57. At Cedarville Accounting Firm, a junior accountant earns x dollars each year. A senior accountant earns \$5,000 less than twice the salary of a junior accountant. Which expression represents the senior accountant's annual earnings?

- * A. $2x - 5,000$
- B. $2(x - 5,000)$
- C. $2(5,000 - x)$
- D. $5,000 - 2x$

Use the information below to answer question 58.

- I $\left\{ \begin{array}{l} 4(x - 1) = 3(x + 2) - 7 \\ 4x - 4 = 3x + 6 - 7 \end{array} \right.$
- II $\left\{ \begin{array}{l} 4x - 4 = 3x - 1 \end{array} \right.$
- III $\left\{ \begin{array}{l} 4x = 3x - 5 \end{array} \right.$
- IV $\left\{ \begin{array}{l} x = -5 \end{array} \right.$

58. Which step in the work shown above is incorrect?

- A. I
- B. II
- * C. III
- D. IV

59. Mrs. Marks made a stem-and-leaf plot of her students' homework scores.

0	8	9							
1	2	2	4	5	6	6	9		
2	1	1	1	3	4	4	5	6	7
3	2	2	4	4	6	6			

What is the mode of the data?

- A. 12
- * B. 21
- C. 27
- D. 36

60. A compact disc is 0.0017 meters thick. Which expresses 0.0017 in scientific notation?

- A. 1.7×10^{-4}
- * B. 1.7×10^{-3}
- C. 1.7×10^3
- D. 1.7×10^4

CALCULATOR PERMITTED ON ALL ITEMS

ALGEBRA I OPEN-RESPONSE ITEM A

- A. Johnson’s Bus Company uses the equation below to determine the rate per person, in dollars, for groups to use the bus:

$$R(n) = 8 - 0.05(n - 80), \text{ where } n \text{ is the number of people in the group}$$

1. What is the rate per person for a group of 100 people? What is the bus company’s income from this group? Show or explain all of your work even if you use mental math or a calculator.
2. By how much does the group size need to increase in order for each person’s rate to decrease by \$0.50? Show or explain all of your work even if you use mental math or a calculator.

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

RUBRIC FOR ALGEBRA I OPEN-RESPONSE ITEM A

Rubric:

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 communicating graphically, algebraically, and verbally real-world problems.
0	No understanding. Work is either incorrect or irrelevant.
Blank	No response.

Score Point Description:

Part 1: Score **2 points** for correct rate per person for a group of 100 people (**7**) **and** the correct income from this group (**700**) with work shown or explanation provided demonstrating correct procedure (at least for finding rate per person).

OR

Score **1 point** for correct rate per person **and** correct income with no work or explanation; **or** for work or explanation demonstrating correct procedures for both rate per person and total income with answer(s) incorrect due to calculation error; **or** for correct rate per person only with work or explanation.

OR

Score **.5 point** for rate per person or correct income with no work or explanation; **or** for work or explanation demonstrating correct procedure for finding the rate per person, but with incorrect answer due to calculation error; **or** for a total income correctly based on an incorrectly determined (due to incorrect procedure) rate per person.

Part 2: Score **2 points** for correct increase in group size with work shown or explanation provided demonstrating correct procedure.

OR

Score **1 point** for correct increase with no work or explanation; **or** for work or explanation demonstrating correct procedure with incorrect answer due to calculation error; **or** for systematic attempt using trial and error and the given equation, but student does not proceed far enough to the correct answer with work or explanation; **or** for finding the correct group size for the first \$.50 discount (90) or an additional \$.50 discount (110) with work or explanation.

Sample Solution:**Part 1: Rate per person: \$7**

$$R(100) = 8 - .05(100 - 80) = 8 - .05(20) = 8 - 1 = 7$$

Income from group of \$100: \$700

$$7(100) = 700$$

Part 2: 10 (people) or 10% or equivalent

$$(7 - .50) = 8 - .05(n - 80)$$

$$6.50 = 8 - .05n + 4$$

$$.05n = 5.5$$

$$n = 110, \text{ so}$$

$$110 - 100 = 10$$

For the rate per person to decrease by \$.50, to \$6.50, the group size would need to be 110 people, which is a 10 person increase from the original group size of 100 people (**or the student may use the given equation and trial and error**).

Note: An answer of 230 passengers or an increase of 130 passengers reflects a rate of \$.50 per person. Students who calculate for a rate of \$.50 per person should receive minimal understanding.

ALGEBRA I OPEN-RESPONSE ITEM B

- B.** The Amazing Museum has a butterfly house of 1,200 butterflies. There are 3 types of butterflies, Swallowtail, Monarch, and Lacey, in a ratio of 5:3:2.
1. The museum staff members randomly catch a butterfly, measure its wing span, and then let it go. Determine the probability that the first butterfly they catch is a Swallowtail butterfly. Show or explain all of your work even if you use mental math or a calculator.
 2. Using the ratio above, determine the number of each type of butterfly in the butterfly house. Show or explain all of your work even if you use mental math or a calculator.
 3. Each week for 5 weeks the museum adds 20 Swallowtails, 96 Monarchs, and 64 Laceys to the butterfly house. Determine the new ratio in lowest terms of butterflies in the house after 5 weeks. 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 B

Rubric:

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 solving equations using ratios and proportions.
0	No understanding. Work is either incorrect or irrelevant.
Blank	No response.

Score Point Description:

- Part 1:** Score **1 point** for correct probability with work shown or explanation provided demonstrating correct procedure.
OR
Score **.5 point** for work or explanation demonstrating correct procedure, but with the incorrect probability due to calculation error; **or** for correct probability, but with no work or explanation.
- Part 2:** Score **2 points** for correct number of each type of butterfly based on the given ratio with work shown or explanation provided demonstrating correct procedure.
OR
Score **1.5 points** for correct procedure or explanation for finding the number of each type of butterfly with answer(s) incorrect due to calculation error(s).
OR
Score **1 point** for the correct number of each type of butterfly with no work or explanation.
- Part 3:** Score **2 points** for the correct new ratio (may be based on incorrect answers to part 2), in lowest terms, with work shown or explanation provided demonstrating correct procedures.
OR
Score **1.5 points** for work or explanation demonstrating correct procedures for determining the new ratio with an incorrect ratio due to calculation error(s); **or** for the correct new ratio, not in lowest terms, with work shown or explanation provided demonstrating correct procedures.
OR
Score **1 point** for the correct new ratio with no work or explanation; **or** for finding the correct number of each type of butterfly after 5 weeks with work or explanation (may be based on incorrect answers to part 2).
OR
Score **.5 point** for finding the number of at least one type of butterfly after 5 weeks; **or** for finding the total number of butterflies after 5 weeks (may be based on incorrect answers to part 2).

Sample Solution:

Part 1: $\frac{1}{2}$ or .5 or 50%
Using the given ratio:
$$\frac{5}{(5 + 3 + 2)} = \frac{5}{10} = \frac{1}{2} = .5$$

Part 2: **600 Swallowtail**
$$\left(\frac{5}{10}\right)(1200) = 600$$

360 Monarch
$$\left(\frac{3}{10}\right)(1200) = 360$$

240 Lacey
$$\left(\frac{2}{10}\right)(1200) = 240$$

Part 3: **5:6:4 (S:M:L)**
of Swallowtail after 5 weeks: $600 + 5(20) = 600 + 100 = 700$
of Monarchs after 5 weeks: $360 + 5(96) = 360 + 480 = 840$
of Laceys after 5 weeks: $240 + 5(64) = 240 + 320 = 560$
The new ratio is:
700:840:560, and dividing through by 140 (the GCF) to get into lowest terms yields: 5:6:4

ALGEBRA I OPEN-RESPONSE ITEM C

- C. Linda and Cal are each saving money to buy a bicycle. The bicycles are \$500 each. Linda has \$100 and will save \$10 of her allowance each week. Cal has \$250 and will save \$5 of his allowance each week.
1. Determine the number of weeks it will take each of them to save \$500. Show or explain all of your work even if you use mental math or a calculator.
 2. After how many weeks will Linda and Cal have the same amount of money? Show or explain all of your work even if you use mental math or a calculator.

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

RUBRIC FOR ALGEBRA I OPEN-RESPONSE ITEM C

Rubric:

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 using and applying linear functions to model the intersections of lines graphically and algebraically.
0	No understanding. Work is either incorrect or irrelevant.
Blank	No response.

Score Point Description:

- Part 1:** Score **.5 point** for correct number of weeks for Linda.
AND / OR
Score **.5 point** for work or explanation demonstrating correct strategy for finding the correct number of weeks for Linda.
AND / OR
Score **.5 point** correct number of weeks for Cal.
AND / OR
Score **.5 point** for work or explanation demonstrating correct strategy for finding the correct number of weeks for Cal.
- Part 2:** Score **2 points** for correct number of weeks with work shown or explanation demonstrating correct strategy.
OR
Score **1 point** for correct number of weeks with no work or explanation; **or** for work or explanation demonstrating correct procedure with incorrect answer due to calculation errors; **or** for a systematic attempt using trial and error, but does not arrive at the correct final answer.

Sample Solution:

Part 1: **Linda: 40 (weeks)**
 $\$100 + 10x = \500
 $10x = 400$
 $x = 40$

Cal: 50 (weeks)
 $\$250 + \$5x = \$500$
 $5x = 250$
 $x = 50$

Part 2: **30 (weeks)**
 $100 + 10x = 250 + 5x$
 $5x = 150$
 $x = 30$

ALGEBRA I OPEN-RESPONSE ITEM E

E. A bicycle race is divided into 4 segments. The length of each segment of the race is shown below.

Segment 1: $8 - (-3 + 7)$ miles

Segment 2: $\frac{2\pi(2 \cdot 2 + 3)}{4}$ miles

Segment 3: $\sqrt{6^2 + 3^2}$ miles

Segment 4: $(3 - 4)^2$ miles

1. Determine the length of each segment of the race. Show or explain all of your work even if you use mental math or a calculator. Round each answer to the nearest tenth.
2. Determine the length of the entire race. Show or explain all of your work even if you use mental math or a calculator. Round your answer to the nearest tenth.

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

RUBRIC FOR ALGEBRA I OPEN-RESPONSE ITEM E

Rubric:

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 the order of operations.
0	No understanding. Work is either incorrect or irrelevant.
Blank	No response.

Score Point Description:

Part 1: Score **.5 point** for *each* correct length.
AND / OR
Score **.5 point** for work or explanation demonstrating correct procedure or determining the length of *each* segment.
(total 4 points)

Part 2: Score **.5 point** for correct length of entire race (may be based on incorrect lengths from part 1).
AND / OR
Score **.5 point** for work or explanation demonstrating correct procedure for determining the length of the entire race.
(total 1 point)

Note: Rounding is a 3 / 4 issue. That is, to receive a 4, the student must round all answers to the nearest tenth. However, there is no deduction for not rounding answers to the nearest tenth at all score points below a 4.

Units are not required. However, units cannot be incorrect. A response cannot receive a 4 with incorrect units, but there is no deduction for incorrect units at all score points below a 4.

Sample Solution:

Part 1: Segment 1: 4.0 (miles)

$$8 - (-3 + 7) = 8 - (4) = 4$$

Segment 2: 11.0 (miles)

$$2(3.14)(2 \cdot 2 + 3) / 4 = 6.28(4 + 3) / 4 = 6.28(7) / 4 = 10.99 \approx 11$$

Segment 3: 6.7 (miles)

$$\sqrt{6^2 + 3^2} = \sqrt{36 + 9} = \sqrt{45} = 6.708203933 \approx 6.7$$

Segment 4: 1 (mile)

$$(3 - 4)^2 = (-1)^2 = 1$$

Part 2: 22.7 (miles)

$$4 + 11 + 6.7 + 1 = 22.7$$

ALGEBRA I OPEN-RESPONSE ITEM F

- F. According to the U.S. Census, the population of the state of Arkansas during the year 2000 was 2.673×10^6 . The total population of the United States during the year 2000 was 2.814×10^8 .
1. Determine the percent of the U.S. population that lived in Arkansas in 2000. Show or explain all of your work even if you use mental math or a calculator. Round your answer to the nearest hundredth of a percent.
 2. The land area of Arkansas is 52,068 square miles. Determine the number of people per square mile in Arkansas for the year 2000. Write your answer in scientific notation. Show or explain all of your work even if you use mental math or a calculator.

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

RUBRIC FOR ALGEBRA I OPEN-RESPONSE ITEM F

Rubric:

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

Score Point Description:

Part 1: Score **2 points** for correct percent with work shown or explanation demonstrating correct procedure.
OR
Score **1 point** for correct percent with no work or explanation; **or** for work or explanation demonstrating correct procedure, but with an incorrect answer due to calculation error; **or** for correct decimal value not converted to a percent with work shown.

Part 2: Score **2 points** for correct answer in scientific notation with work shown or explanation demonstrating correct procedure.
OR
Score **1 point** for correct answer in scientific notation with no work or explanation; **or** for work or explanation demonstrating correct procedure, but with an incorrect answer due to calculation error; **or** for correct decimal value with either no or incorrect conversion to scientific notation.

Note: Not rounding to the nearest hundredth of a percent in part 1 is a 3 / 4 issue.

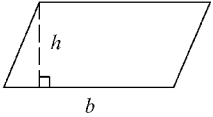
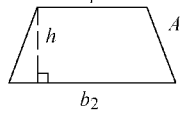
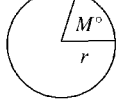
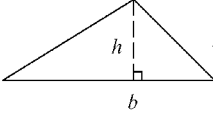
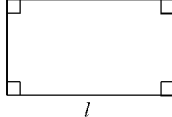
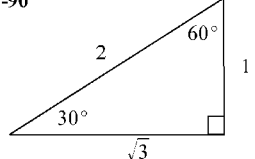
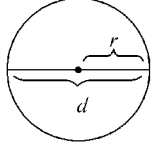
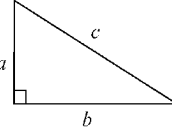
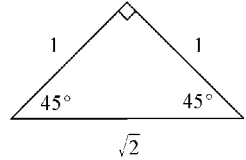
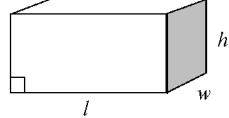
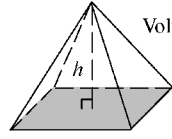
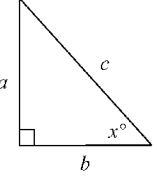
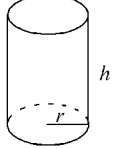
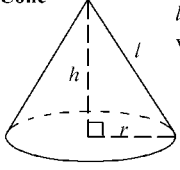
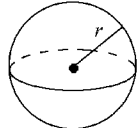
Sample Solution:

Part 1: **95%**
 $(1.673 \times 10^6) / (2.814 \times 10^8) = .94989339 \times 10^{-2} = .0094989339 \approx .95\%$
 or, $2,673,000 / 281,400,000 = .009498934 \approx .95\%$

Part 2: $\approx 5.1 \times 10^1$
 $2.673 \times 10^6 / 5.2068 \times 10^4 = 5.13367135 \times 10^1$
 or, $2,673,000 / 52,068 = 51.33671353 = 5.13367135 \times 10^1$

End of Course Mathematics Reference Sheet

This reference sheet was used in the Midyear 2005 testing. Changes or additions may occur in future testing.

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

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

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

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

ACTAAP

Arkansas
Comprehensive Testing, Assessment
& Accountability Program

**Developed for the Arkansas Department of Education • Little Rock, AR 72201
Developed by Data Recognition Corporation**