



Arkansas
Comprehensive Testing, Assessment
& Accountability Program

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

April 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 spring semester participated in the *Algebra I Spring End of Course Examination* in April of 2005.

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 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 April 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 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.

PART II Released Multiple-Choice Items — Algebra I

1. A plumber extended the length (x) of an existing drainpipe. He doubled the length and added 7 more inches. The extended drainpipe has a total length of 32 inches. Which equation represents the length of the extended drainpipe?
- A. $2x - 7 = 32$
* B. $2x + 7 = 32$
C. $2(x + 7) = 32$
D. $7(2x) = 32$
2. Mark has \$100 in his bank account. He spends \$5 per week on comic books. After how many weeks will Mark first have less than \$20 in his bank account?
- A. 5 weeks
B. 6 weeks
* C. 17 weeks
D. 25 weeks
3. What is the domain of $F = \{(2, 1), (4, 3), (7, 8), (9, 8)\}$?
- A. $\{1, 2, 3, 4, 5, 6, 7, 8, 9\}$
B. $\{1, 2, 3, 4, 7, 8, 9\}$
C. $\{1, 3, 8\}$
* D. $\{2, 4, 7, 9\}$
4. Jenny's dog had 6 puppies that weighed 20 ounces, 16 ounces, 22 ounces, 16 ounces, 19 ounces, and 15 ounces at birth. What is the mode weight of the puppies?
- A. 6 ounces
* B. 16 ounces
C. 17.5 ounces
D. 18 ounces
5. Solve:
- $$2x^2 - 4x = 6$$
- * A. $x = -1$ or $x = 3$
B. $x = 1$ or $x = -3$
C. $x = 2$ or $x = 0$
D. $x = -2$ or $x = 0$

Use the matrices below to answer question 6.

	Regular Price (dollars)		Sale Price (dollars)	
	Pants	Shirts	Pants	Shirts
Blue	35	22	25	18
Red	28	25	22	21
Black	30	18	25	16

6. Dan bought 1 shirt and 1 pair of pants in each color at the sale prices. Which matrix shows how much money Dan saved on each item?

A. $\begin{bmatrix} 13 & 7 \\ 3 & 1 \\ 12 & 9 \end{bmatrix}$

B. $\begin{bmatrix} 60 & 40 \\ 50 & 46 \\ 55 & 34 \end{bmatrix}$

C. $\begin{bmatrix} 10 & 17 \\ 6 & 7 \\ 5 & 14 \end{bmatrix}$

* D. $\begin{bmatrix} 10 & 4 \\ 6 & 4 \\ 5 & 2 \end{bmatrix}$

7. Mitch has 2 trees in his yard. The height of the taller tree is 4 feet more than 3 times the height of the shorter tree (s). Which expression represents the height of the taller tree?

- * A. $3s + 4$
- B. $3s - 4$
- C. $3(s + 4)$
- D. $3(s - 4)$

8. Simplify:

$$-3x + 5y - 2y + 4 + 5x$$

- A. 9
- B. $9xy$
- C. $2x + 3y$
- * D. $2x + 3y + 4$

9. Which is an equation?

- A. $3x + 2$
- B. $2x + 3x + 6$
- * C. $4x + 2 = 10$
- D. $6 + 3x + 4$

10. Which represents the sum of 4 and 5 added to the product of -3 and 2?

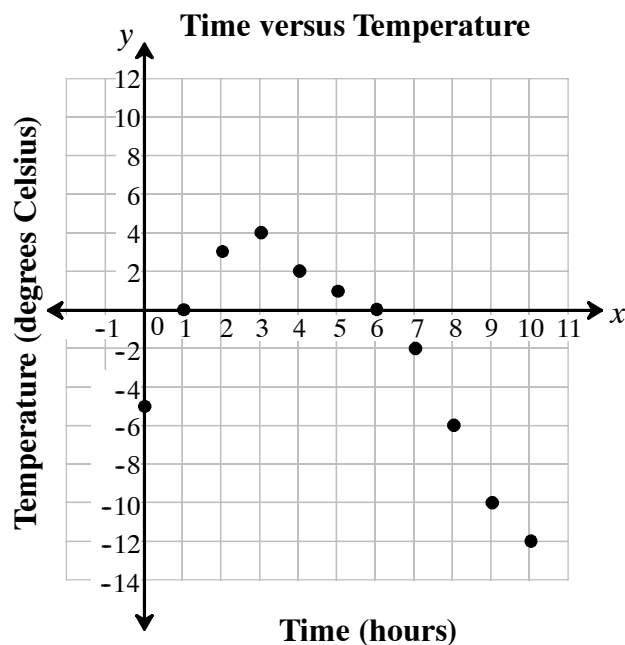
- * A. 3
- B. 8
- C. 14
- D. 19

11. Solve:

$$3x + 2 \geq 7$$

- A. $x \leq \frac{5}{3}$
- * B. $x \geq \frac{5}{3}$
- C. $x \leq 3$
- D. $x \geq 3$

Use the graph below to answer question 12.



12. As a cold front approached, Keith recorded the time-versus-temperature data above. What are the zeros of this function?

- A. $(0, 0), (1, 0)$
- B. $(1, 0), (3, 0)$
- * C. $(1, 0), (6, 0)$
- D. $(6, 0), (10, 0)$

13. The exam scores from a small algebra class are 61, 73, 83, 94, and 94. What is the mean of the scores?

- A. 61
- * B. 81
- C. 83
- D. 94

Use the equation below to answer question 14.

$$f(x) = 3x + 4$$

14. What is $f(2)$?
- A. 6
 - B. 7
 - * C. 10
 - D. 14
15. The speed of light is 1.86×10^5 miles per second. How many miles does light travel in 1 hour?
- A. 6.696×10^5
 - B. 3.348×10^6
 - C. 5.58×10^7
 - * D. 6.696×10^8
16. Kara pays her electric bill every month. During the 6 warmest months, her bill is x dollars each month. During the 6 coldest months, her bill is y dollars each month. Kara's annual cost is shown in the formula below:
- $$\text{Annual Electric Cost} = 6(x + y)$$
- Kara simplified the right side of the equation to be $6x + 6y$.
- Which algebraic property did Kara use?
- A. associative
 - B. commutative
 - * C. distributive
 - D. reflexive

17. Albert has a water pump that fills a 750-gallon tank in 35 minutes. About how long will it take Albert to fill a 1,000-gallon tank with the same pump?

A. 26 minutes
 * B. 47 minutes
 C. 215 minutes
 D. 250 minutes

18. Joe planted 315 acres of beans and hay. He planted 85 more acres of beans (b) than hay (h). Joe wrote the 2 equations below to represent the amount of each crop he planted:

$$b + h = 315$$

$$b = h + 85$$

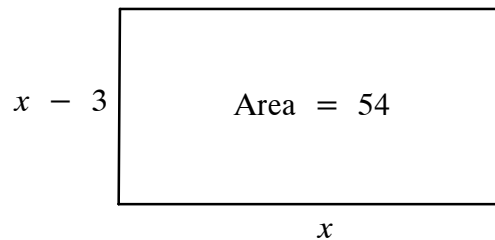
How many acres of each crop did Joe plant?

* A. 200 of beans and 115 of hay
 B. 115 of beans and 200 of hay
 C. 230 of beans and 85 of hay
 D. 85 of beans and 230 of hay

19. A telephone service costs \$15 per month plus 10 cents per minute. Which is the correct function notation for this relationship, where m is the number of minutes?

A. $C(m) = 15m + 0.10$
 B. $C(m) = 15.10m$
 C. $C(m) = 15m + 0.10m$
 * D. $C(m) = 15 + 0.10m$

Use the figure below to answer question 20.



(Not drawn to scale.)

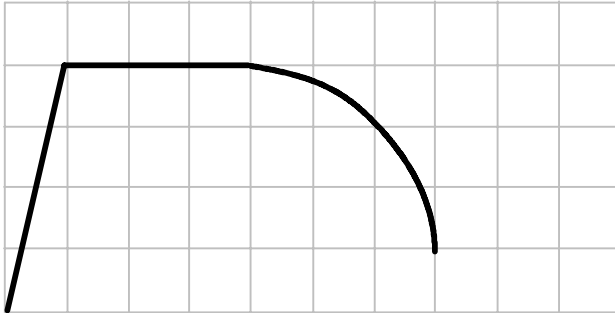
20. Tim wrote this equation to find the area of the rectangle above:

$$x(x - 3) = 54$$

Which equation is equivalent to the one Tim wrote?

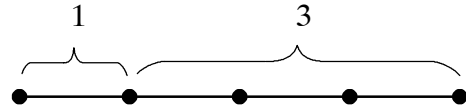
* A. $x^2 - 3x - 54 = 0$
 B. $x^2 - 3x + 54 = 0$
 C. $x^2 + 3x - 54 = 0$
 D. $x^2 + 3x + 54 = 0$

Use the graph below to answer question 21.



21. The length of the line in the graph can be found by simplifying $\sqrt{(4^2 + 1^2)} + 3 + \frac{(2)(\pi)(3)}{4}$. What is the length of the line? (Round to the nearest hundredth.) Use $\pi = 3.14$.
- A. 6.49
 B. 10.87
 * C. 11.83
 D. 12.71
22. The distance between Earth and the star Alpha Centauri is about 25×10^{12} miles. One light-year measures 5.83416×10^{12} miles. About how many light-years are between Earth and Alpha Centauri?
- A. 0.23
 B. 3.3
 * C. 4.3
 D. 15

Use the figure below to answer question 23.



23. A length of wire needs to be cut in a ratio of 1:3. The original length of the wire was 24 inches. After the wire has been cut, what is the length of the longer piece of wire?
- A. 6 inches
 * B. 18 inches
 C. 20 inches
 D. 23 inches
24. Suzzi is training for her upcoming athletic season. She set a goal to run at least 40 miles in 7 days. She ran 4 miles on the first day. What is the least number of miles she must run over each of the remaining 6 days to reach her goal?
- A. 4 miles
 * B. 6 miles
 C. $7\frac{1}{3}$ miles
 D. 30 miles

PART II Released Multiple-Choice Items — Algebra I

25. Joe's car gets 20 miles per gallon of gas. Which table represents the relationship between gallons of gas and distance traveled?

A.

Gallons	Distance
1	20
2	10
4	5
5	4

B.

Gallons	Distance
0	20
1	40
2	60
3	80

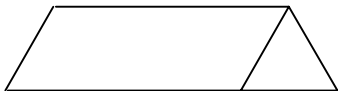
C.

Gallons	Distance
1	20
2	30
3	40
4	50

* D.

Gallons	Distance
1	20
2	40
3	60
4	80

Use the figure below to answer question 26.



26. In the figure above, the area of the parallelogram is $4x^2 - 6x - 3$. The area of the triangle is $2x^2 + 3x - 8$. What is the total area of the 2 shapes?

- * A. $6x^2 - 3x - 11$
- B. $8x^2 - 18x + 24$
- C. $6x^2 + 9x - 11$
- D. $2x^2 - 9x + 5$

27. Jacob has a triangular flowerbed. Each side of the flowerbed is a different length. The lengths of the sides are the first 3 odd prime numbers. What is the difference between the longest side and the shortest side?

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

28. Which represents a function?

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

Use the matrix below to answer question 29.

$$\text{Matrix T} = \begin{bmatrix} 10 & 0 \\ 50 & 70 \\ 30 & -50 \end{bmatrix}$$

29. What is $4T$?

* A. $\begin{bmatrix} 40 & 0 \\ 200 & 280 \\ 120 & -200 \end{bmatrix}$

B. $\begin{bmatrix} 14 & 4 \\ 54 & 74 \\ 31 & -46 \end{bmatrix}$

C. $\begin{bmatrix} 10 & 0 \\ 50 & 70 \end{bmatrix}$

D. $\begin{bmatrix} 10 & 0 & 50 & 70 \end{bmatrix}$

Use the table below to answer question 30.

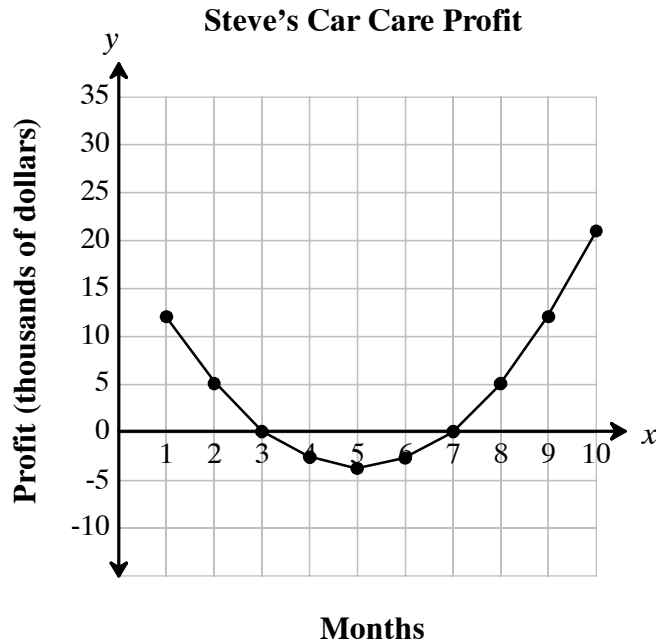
Tory's Shoe Sales

Shoe Size	Number Sold
8	5
$8\frac{1}{2}$	8
9	15
$9\frac{1}{2}$	21
10	20
$10\frac{1}{2}$	19
11	12
$11\frac{1}{2}$	6
12	2

30. Tory runs a shoe store. He recorded his sales by shoe size, as shown above. What is the mode size of shoe sold?

- A. 8
- * B. $9\frac{1}{2}$
- C. 10
- D. 12

Use the graph below to answer question 31.



31. The graph above shows the profit for Steve's Car Care for the first 10 months of the year. What are the zeros of the graph?
- A. (0, 0) and (5, -4)
 - B. (1, 12) and (10, 21)
 - * C. (3, 0) and (7, 0)
 - D. (5, -4) and (10, 21)

32. What is the value of $\frac{4(3 - w)}{2w}$ when $w = -3$?

- * A. -4
- B. 0
- C. 4
- D. 12

33. Factor:

$$x^2 + x - 12$$

- * A. $(x - 3)(x + 4)$
- B. $(x + 3)(x - 4)$
- C. $(x + 3)(x + 4)$
- D. $(x - 3)(x - 4)$

34. Which is an expression?

- A. $3y + 7x < 5$
- * B. $3y + 7x - 5$
- C. $3y + 7x = 5$
- D. $3y + 7x \geq 5$

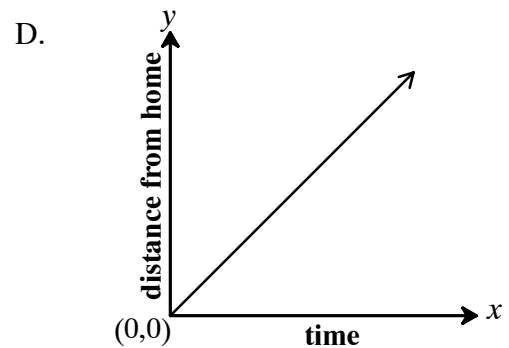
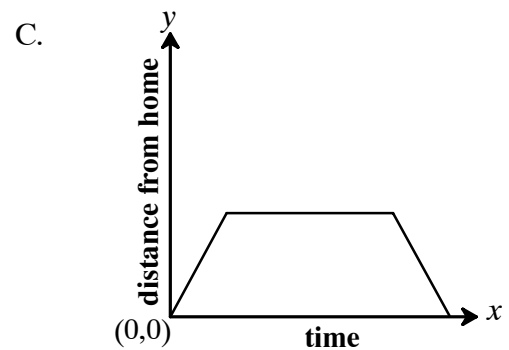
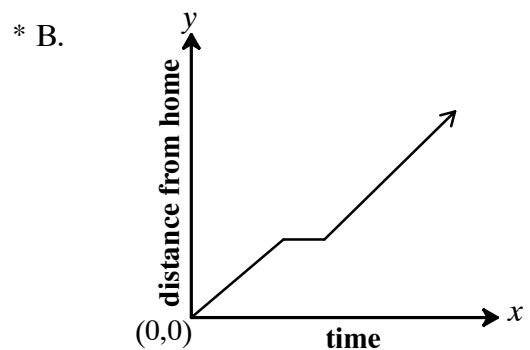
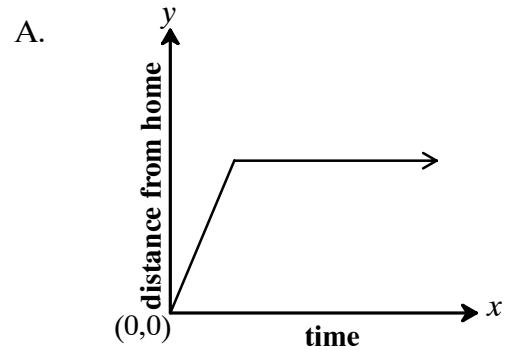
Use the system of equations below to answer question 35.

$$\begin{cases} 4x + 2y = 4.10 \\ 3x + 5y = 5.00 \end{cases}$$

35. Jasper spent \$4.10 on 4 candy bars and 2 cans of soda. Cecelia spent \$5.00 on 3 candy bars and 5 cans of soda. After solving the system of equations above, which best describes the situation?

- A. Jasper spent \$0.55 on candy bars and \$0.75 on soda.
- B. Jasper spent an average of \$0.55 and Cecelia spent an average of \$0.75.
- C. Candy bars cost \$0.55 and soda costs \$0.75.
- * D. Candy bars cost \$0.75 and soda costs \$0.55.

36. Kate has a 20-minute drive to work. She stopped at one stoplight before arriving at work. Which graph shows Kate's drive?



PART II Released Multiple-Choice Items — Algebra I

37. A scientist recorded a data set of approximate altitude (kilometers) versus temperature (degrees Celsius):

$$\{(10, -40), (20, -55), (30, -42), (40, -20), (50, -3)\}$$

What is the domain of this relation?

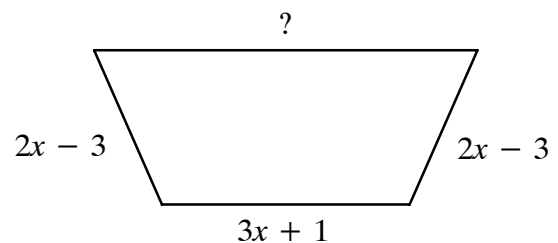
- A. 40
- B. 52
- C. $\{-55, -42, -40, -20, -3\}$
- * D. $\{10, 20, 30, 40, 50\}$

38. Solve:

$$5x - 3 < 2x + 4$$

- A. $x < -1$
 - B. $x < \frac{3}{7}$
 - C. $x < 1$
 - * D. $x < \frac{7}{3}$
39. An Internet company charges \$9.95 per month plus \$0.05 per hour of usage. Mary used 80 hours in January. How much will she be charged?
- * A. \$13.95
 - B. \$25.95
 - C. \$49.95
 - D. \$409.95

Use the figure below to answer question 40.



40. The perimeter of the trapezoid above is $10x - 1$. What is the length of the longest base?
- A. $3x - 6$
 - B. $3x - 4$
 - * C. $3x + 4$
 - D. $7x - 5$

41. Which represents the statement “the sum of 5 and a number is less than or equal to -8”?

- * A. $x + 5 \leq -8$
- B. $x + 5 < -8$
- C. $x + 5 \geq -8$
- D. $5x \leq -8$

42. 69% of the students at a school are involved in after-school activities. There are 598 students in the school. Which is the best estimate of the number of students in after-school activities?

- A. 360 students
- B. 380 students
- * C. 420 students
- D. 450 students

Use the system of equations below to answer question 43.

$$\begin{cases} y = 3x - 1 \\ y = -2x + 4 \end{cases}$$

43. Where will the lines intersect?

- A. $\left(\frac{3}{5}, \frac{4}{5}\right)$
- * B. (1, 2)
- C. (3, 8)
- D. (5, 14)

44. Which chart represents a function?

A.

Ounces	Calories
4	200
1.5	350
2	300
4	400

B.

Gallons	Distance
14	350
10	200
14	210
8	184

* C.

Width	Perimeter
4	12
3	12
2	12
1	12

D.

Width	Area
2	16
4	16
2	18
3	24

45. One raindrop has a mass of 0.000001 kg. What is the total mass of 5 raindrops in scientific notation?

- A. 1×10^{-6} kg
- B. 1×10^6 kg
- * C. 5×10^{-6} kg
- D. 5×10^6 kg

46. Which must be a whole number?

- A. the time it takes to drive 300 miles at 55 mph
- B. the area of a circle with a radius of 5 feet
- C. the area of a triangle with base of 15 and height of 9
- * D. the number of books in 12 bookstores

PART II Released Multiple-Choice Items — Algebra I

47. The Barnett family's phone bill for 2 months was:

January	91 minutes long distance	\$42.30
February	142 minutes long distance	\$57.60

Using the pattern, which equation represents the cost (C) of a phone bill for m minutes of long distance?

- * A. $C = 0.30m + 15$
- B. $C = 0.30m + 78.31$
- C. $C = 3.33m - 260.73$
- D. $C = 15m + 0.30$

-
48. A woman's height (H) in inches can be estimated by the length of her thigh bone (b) using the following formula:

$$H = 1.95b + 28.68$$

To the nearest hundredth, what is the height of a woman whose thigh bone is 18 inches long?

- A. 30.63 inches
- B. 48.63 inches
- * C. 63.78 inches
- D. 91.03 inches

49. Will had \$250 and spent \$7.50 per movie ticket. The function $f(m) = 250 - 7.50m$ represents the amount of money Will has after seeing m movies. After seeing how many movies will he have \$10 left?

- A. 30
- * B. 32
- C. 34
- D. 35

50. Completely factor:

$$3x^2 + 6x$$

- A. $9x^2$
 B. $3(x^2 + 2x)$
 C. $x(3x + 6)$
 * D. $3x(x + 2)$
51. The Saunders and Smith Fuel Company delivers home heating oil for 89.9¢ per gallon, plus a charge of \$10.00 for delivery. Which equation would the company use to compute a customer's cost (C) in dollars for a purchase of g gallons?
- * A. $C = 0.899g + 10$
 B. $C = 10 + g$
 C. $C = 10g + 0.899$
 D. $C = 10g + 0.899g$
52. The factory listing on Clint's new car indicated the average mileage would be 30 miles per gallon (mpg). Clint's gas mileages for the past 3 weeks were 27 mpg, 31 mpg, and 30 mpg. How many miles per gallon must Clint's car get next week so that the average is equal to the factory listing?
- A. 29
 B. 30
 * C. 32
 D. 33

53. It is 234 miles from Little Rock to Gravette. Richard has already driven 60 miles and is currently traveling at a speed of 65 miles per hour. About how long will the rest of the trip take?

- A. 2 hours
 * B. 3 hours
 C. 5 hours
 D. 66 hours

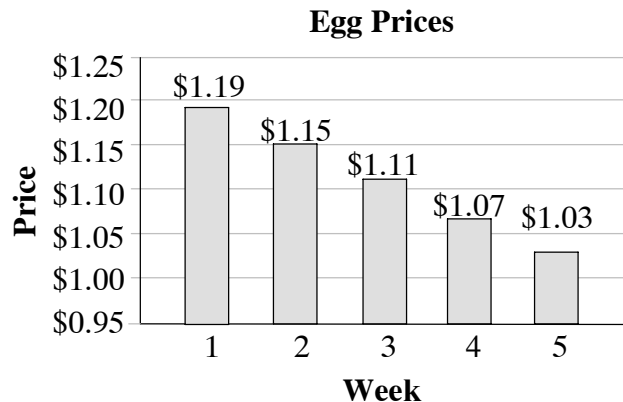
Use the table below to answer question 54.

Monthly Internet Access

Hours	Cost
20	\$15
30	\$20
50	\$30
100	\$45
200	\$55

54. The cost of Internet access is shown in the table above. What is the independent variable in this situation?
- A. type of service
 B. cost per month
 C. cost per hour
 * D. hours per month

Use the graph below to answer question 55.



55. The graph above shows the price for a dozen eggs over the past 5 weeks. The price continues to change at the same rate. What will be the price next week?

- * A. \$0.99
- B. \$1.03
- C. \$1.11
- D. \$1.19

56. Solve for f :

$$f^2 - 2f + 1 = 0$$

- * A. $f = 1$ only
- B. $f = -1, 1$
- C. $f = -1, 2$
- D. $f = -1$ only

Use the table below to answer question 57.

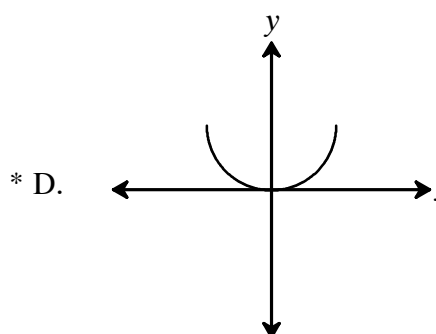
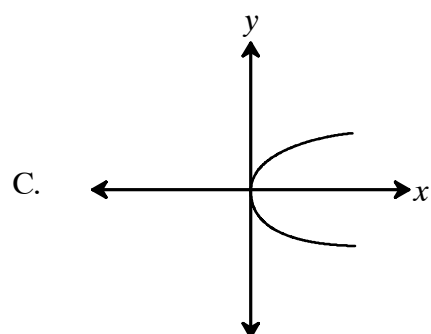
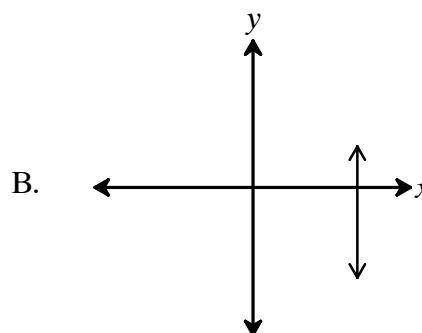
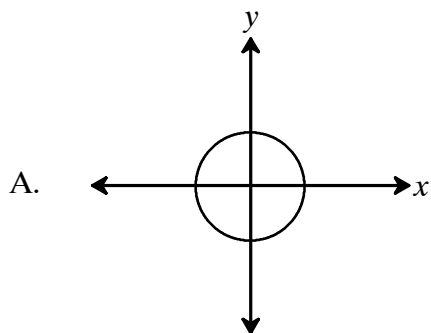
Light Bulb Replacement

Month	Number of Bulbs Replaced
January	3
February	4
March	2
April	8
May	4
June	2
July	0
August	1
September	2
October	0
November	7
December	5

57. The number of light bulbs replaced last year in the school auditorium is shown in the table above. What was the mean number of bulbs replaced per month? (Round to the nearest tenth.)

- A. 2.0
- B. 2.5
- * C. 3.2
- D. 3.8

58. Which graph represents a function?



59. Jess raked leaves at a constant rate of 40 square meters per hour. How long did it take her to rake an area of 100 square meters?

- A. $\frac{2}{5}$ hour
- B. $\frac{2}{3}$ hour
- C. 1 hour
- * D. $2\frac{1}{2}$ hours

60. The area of a triangle is $6x^2 - 12x + 3$. What is this area in factored form?

- * A. $3(2x^2 - 4x + 1)$
- B. $3(x^2 - 4x + 1)$
- C. $6(x^2 - 2x + 2)$
- D. $2(3x^2 - 6x + 1)$

CALCULATOR PERMITTED ON ALL ITEMS

ALGEBRA I OPEN-RESPONSE ITEM A

- A. Melinda drove 21 miles to Carrie’s house at an average speed of 33 miles per hour.
1. Determine the amount of time it took Melinda to drive to Carrie’s house. Show or explain all of your work even if you use mental math or a calculator.
 2. After her visit, it took Melinda $\frac{1}{2}$ hour to drive 18 miles from Carrie’s house to a store. Determine the rate that Melinda drove from Carrie’s house to the store. 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).

PART III Released Open-Response Items — Algebra I

RUBRIC FOR ALGEBRA I OPEN-RESPONSE ITEM A

Rubric:

SCORE	DESCRIPTION
4	The student earns 4 points.
3	The student earns 3 points.
2	The student earns 2 – 2.5 points.
1	The student earns .5 – 1.5 points. OR The response demonstrates minimal understanding of solving equations involving real-world applications.
0	No understanding. Work is either incorrect or irrelevant.
Blank	No response.

Score Point Description:

Part 1: Score **2 points** for the correct time with work shown or explained.
OR
Score **1 point** for the correct time with incomplete or no work shown or explained;
or for correct procedures shown with an incorrect time due to a calculation or copy error.
OR
Score **.5 point** for some correct procedure shown or explained.

Part 2: Score **2 points** for correct rate with work shown or explained.
OR
Score **1 point** for correct rate with incomplete or no work shown or explained;
or for correct procedures shown with an incorrect answer due to a calculation or copy error.
OR
Score **.5 point** for some correct procedure shown or explained.

Sample Solution:

Part 1: **0.64 hours or 38.4 minutes**

$$d = rt$$

$$t = d/r$$

$$t = 21/33$$

$$t = 7/11 \text{ or about } .64 \text{ hours}$$

$$.64 \times 60 = 38.4 \text{ minutes}$$

or equivalent

Part 2: **36 mph**

$$r = d/t$$

$$r = 18/.5$$

$$r = 36 \text{ miles per hour}$$

or equivalent

ALGEBRA I OPEN-RESPONSE ITEM B

- B.** Jamar and Bonita work in the marketing department of a computer company. Each developed a model to predict the annual profit for the company for the next 10 years:

$$\text{Jamar's model: } P_1 = 0.2t + 3.1$$

$$\text{Bonita's model: } P_2 = 0.3t + 2.4$$

where t is time in years from 1 to 10 and P_1 and P_2 represent profit in millions of dollars.

1. Explain how the 2 equations model profit. Be sure to describe any similarities or differences between the models. Show or explain all of your work even if you use mental math or a calculator.
2. Determine the year when the 2 models will show equal profits. 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 B

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 intersection of lines algebraically.
0	No understanding. Work is either incorrect or irrelevant.
Blank	No response.

Score Point Description:

- Part 1:** Score **2 points** for a complete and correct explanation.
OR
Score **1 point** for an explanation that demonstrates an understanding of either the constant term or the coefficient of t as it applies to the profit.
OR
Score **.5 point** for some correct explanation (e.g., both models predict increasing profits or student gives a literal comparison of the two models).
- Part 2:** Score **2 points** for a correct answer with work shown or explained.
OR
Score **1.5 points** for a correct answer with an indication that $P_1(7) = 4.5 = P_2(7)$.
OR
Score **1 point** for a correct answer with no work shown or explained; **or** for correct procedures shown with an incorrect answer due to a calculation or copy error.
OR
Score **.5 point** for some correct procedure shown or explained.

Sample Solution:

Part 1: Jamar thinks that the profit each year will be greater than 3.1 million dollars. The amount above that base will increase at a steady rate of \$200,000 each year. Bonita expects that the profit will be at least 2.4 million dollars, but the amount above that base will increase at a steady rate of \$300,000 per year. Both predict that the profits will see a steady growth. Jamar expects the first year to be higher than Bonita does, but maintains a lower rate of increase than Bonita.

Part 2: 7 years

$$P_1 = P_2$$

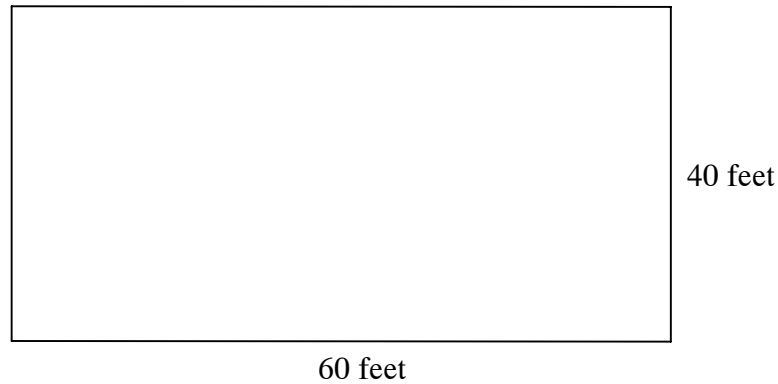
$$0.2t + 3.1 = 0.3t + 2.4$$

$$3.1 - 2.4 = 0.3t - 0.2t$$

$$0.7 = 0.1t$$

$$t = 7 \text{ years}$$

ALGEBRA I OPEN-RESPONSE ITEM C



(Not drawn to scale.)

- C. The parking lot at George’s Grocery is 60 feet long and 40 feet wide. George plans to expand the parking lot by increasing the length and the width by the same amount (x).
1. Write an expression in terms of x to represent the new length. Write a second expression in terms of x to represent the new width.
 2. George plans to build a fence all the way around the expanded lot except for a 15-foot entrance. Write an expression in terms of x that represents the amount of fence George needs to buy. Show or explain all of your work even if you use mental math or a calculator.
 3. The expanded parking lot will have twice the area of the original parking lot. Determine the dimensions of the expanded parking lot. Show or explain all of your work even if you use mental math or a calculator. Include units in your answer.

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

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 integrating Algebra and Geometry in problems involving area and perimeter.
0	No understanding. Work is either incorrect or irrelevant.
Blank	No response.

Score Point Description:

Part 1: Score **1 point** for two correct expressions.
OR
Score **.5 point** for one correct expression.

Part 2: Score **1 point** for correct expression.
OR
Score **.5 point** for correct expression for perimeter (the entrance is not subtracted); **or** for an incorrect expression due to an error in simplification.

(Part 2 may be based on one or more incorrect expressions from Part 1.)

Part 3: Score **2 points** for correct dimensions with work shown or explained.
OR
Score **1 point** for correct dimensions with no work shown or explained; **or** for one correct dimension with work shown or explained; **or** for work shown demonstrating correct procedure with an incorrect answer due to a calculation or copy error.
OR
Score **.5 point** for one correct dimension with no work shown or explained; **or** for some correct procedure shown for determining the new dimensions.

Note: Correct units are required with the answer in Part 3. Therefore, to receive a 4, the student must label the answer with the correct units. Do not penalize for incorrect or missing units at all score points below 4.

Sample Solution:

Part 1: **Length:** $60 + x$
 Width: $40 + x$

Part 2: **$2(60 + x) + 2(40 + x) - 15$**
 Student may simplify the expression $120 + 2x + 80 + 2x - 15 = 4x + 185$

Part 3: **Length: 80 feet**
 Width: 60 feet
 $60 \times 40 \times 2 = 4,800$
 $4,800 = (60 + x)(40 + x)$
 $4,800 = 2,400 + 100x + x^2$
 $0 = x^2 + 100x - 2,400$
 $0 = (x + 120)(x - 20)$
 $x = -120$ or $x = 20$
 only $x = 20$ can be correct for lengths
 new length is 80 feet and new width is 60 feet
 OR
 $4,800 = l w$
 $60 (80) = 4,800$
 $40 + 20 = 60$
 $60 + 20 = 80$
 so new length is 80 feet
 new width is 60 feet

ALGEBRA I OPEN-RESPONSE ITEM E

E. Chad has a total of 5 people in his family.

- Sally is Chad’s twin sister.
 - Chad’s sister Hailey is 4 years older than Chad.
 - Chad’s mother was 24 when Chad was born.
 - Chad’s father is 3 years older than his mother.
1. Write an expression for each family member’s age as a function of Chad’s age (x). Clearly label each expression. Show or explain all of your work even if you use mental math or a calculator.
 2. The average age of the 5 family members is 22. Determine the age of Chad’s sister Hailey. 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 E

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 translating word expressions to symbolic expressions.
0	No understanding. Work is either incorrect or irrelevant.
Blank	No response.

Score Point Description:

Part 1: Score **.5 point** for **each** correct expression.
OR
Score **.5 point** total for correct expression(s) not in terms of Chad.

Part 2: Score **2 points** for correct age of Hailey with work shown or explained.
OR
Score **1 point** for correct age of Hailey with incomplete or no work shown or explained; **or** for correct procedures shown with an incorrect answer due to a calculation or copy error; **or** for correct age of Chad with work shown or explained.
OR
Score **.5 point** for some correct procedure shown or explained.

(Part 2 may be correct based on one or more incorrect expressions in Part 1.)

In Part 1, each expression must be clearly labeled for a 4.

Sample Solution:

Part 1: Chad = x (not required — given)
Sally = x
Hailey = $x + 4$
Mother = $x + 24$
Father = $x + 27$

Part 2: **15**
 $(x + x + x + 4 + x + 24 + x + 27)/5 = 22$
 $5x + 55 = 110$
 $5x = 55$
 $x = 11$
Hailey = $x + 4 = 11 + 4 = 15$

ALGEBRA I OPEN-RESPONSE ITEM F

- F. Julie needs to have her car repaired. Mechanic Mike charges a fee of \$25 plus \$30 per hour, plus the cost of any new car parts. He tells Julie that the cost of the parts will be \$235. This situation is represented in the function below:

$$C = 25 + 30t + p$$

In this function, C is the total cost, t is the number of hours, and p is the cost for new parts.

- Julie wants to find the cost of her auto repair based on the number of hours for the repairs mechanic Mike will do. Copy and complete the table below in your Student Answer Document using the information and function above. Show or explain all of your work even if you use mental math or a calculator.

Cost of Auto Repair

t	0	2	4	6
C				

- Julie's car has a value of \$770. Determine how long mechanic Mike can work on her car before the total charge equals the car's value. Show or explain all of your work even if you use mental math or a calculator.
- Julie decides to get a second estimate. Mechanic Betty uses the same cost equation as mechanic Mike. However, mechanic Betty will buy used parts that cost 30% less than the new parts mechanic Mike will buy. Determine how long mechanic Betty can work on Julie's car before the total charge equals the car's value. 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 F

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 functions to communicate algebraically real-world problems.
0	No understanding. Work is either incorrect or irrelevant.
Blank	No response.

Score Point Description:

- Part 1:** Score **1 point** for correct table with work shown or explained.
OR
Score **.5 point** for some correct value(s) of the function; **or** for work shown demonstrating some correct procedure.
- Part 2:** Score **1 point** for correct answer with work shown or explained.
OR
Score **.5 point** for correct answer with incomplete or no work shown; **or** for some correct procedure shown or explained.
- (Part 2 may be based on incorrect values from Part 1.)
- Part 3:** Score **2 points** for correct answer with work shown or explained.
OR
Score **1 point** for correct answer with incomplete or no work shown; **or** for correct procedure shown with an incorrect answer due to one or two minor calculation or copy error(s).
OR
Score **.5 point** for some correct procedure shown or explained.

Sample Solution:**Part 1:**

t	0	2	4	6
C	260	320	380	440

$$t = 0: C = 25 + 30(0) + 235 = 260$$

$$t = 2: C = 25 + 30(2) + 235 = 320$$

$$t = 4: C = 25 + 30(4) + 235 = 380$$

$$t = 6: C = 25 + 30(6) + 235 = 440$$

Part 2: 17 hours

$$770 = 30t + 260$$

$$510 = 30t$$

$$17 = t$$

17 hours

Part 3: 19.35 hours or 19 hours and 21 minutes

$$235(0.7) = 164.50 \text{ for used parts}$$

$$770 = 30t + 25 + 164.50$$

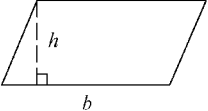
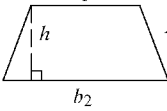

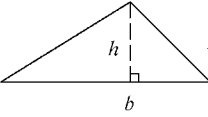
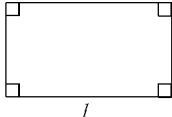
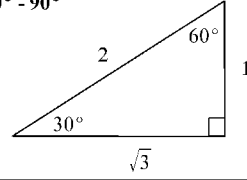
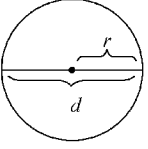
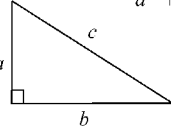
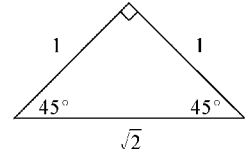
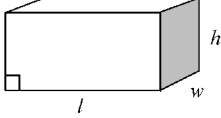
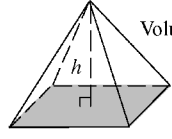
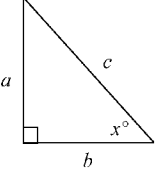
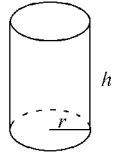
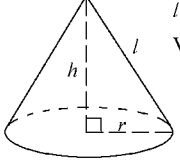
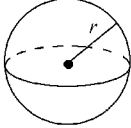
$$580.5 = 30t$$

$$19.35 = t$$

19.35 hours with Betty

End of Course Mathematics Reference Sheet

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

<p>Parallelogram</p>  <p>$P =$ 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>$P =$ 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>$B =$ 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 = $2\pi r h + 2\pi r^2$</p>	<p>Cone</p>  <p>$l =$ slant height Volume = $\frac{\pi r^2 h}{3}$ Surface area = $\pi r l + \pi r^2$</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	$A = \frac{s^2\sqrt{3}}{4}$ $s =$ length of a side
	Distance	rate • time
	Interest	principal • rate • time in years
	Sum of the interior angles of a polygon having n sides	$(n - 2)180^\circ$
	Distance between points on a coordinate plane	$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
	Midpoint	$\left(\frac{x_2 + x_1}{2}, \frac{y_2 + y_1}{2}\right)$
	Slope of a nonvertical line (where $x_2 \neq x_1$)	$m = \frac{y_2 - y_1}{x_2 - x_1}$
	Slope intercept (where $m =$ slope, $b =$ intercept)	$y = mx + b$
	Last term of an arithmetic series	$a_n = a + (n - 1)d$
	Last term of a geometric series (where $n \geq 1$)	$a_n = ar^{n-1}$
	Quadratic formula	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
	Area of a square	$A = s^2$
	Volume of a cube	$V = s^3$
Area of a regular polygon	$A = \frac{1}{2} ap$ $a =$ apothem, $p =$ perimeter	

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

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

*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**