



Arkansas Comprehensive Testing, Assessment, and Accountability Program

Released Item Booklet

Algebra I End-of-Course Examinations

January and April 2009 Administrations

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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) are being developed in response to Arkansas Legislative Act 35, which requires the State Board of Education to develop a comprehensive testing program that includes assessment of the challenging academic content standards defined by the Arkansas Curriculum Frameworks.

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 Mid-Year End-of-Course Examination* in January 2009, and students who had completed or were completing Algebra I by the end of the spring semester participated in the *Algebra I End-of-Course Examination* in April 2009.

This Released Item Booklet for the *Algebra I End-of-Course Examinations* contains test questions or items that were asked of students during the operational administrations in January 2009 and April 2009. The test items included in Parts II and III of this booklet are those items that contributed to the student performance results for that administration.

Students were given approximately an hour and a half each day of testing during the January 2009 administration and approximately two hours each day of testing during the April 2009 administration to complete assigned test sessions during the two days of testing. 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 the reference sheet on page 20 of this booklet.) All of the multiple-choice items within this booklet have the correct response marked with an asterisk (*).

The development of the *Algebra I End-of-Course Examinations* was based on the Arkansas *Algebra I Mathematics Curriculum Framework*. This framework has distinct levels: *Strands* to be taught in concert, *Content Standards* within each Strand, and *Student Learning Expectations* within each Content Standard. An abridged version of the Arkansas *Algebra I 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 Standard, and Student Learning Expectation associated with each item. However, since many key concepts within the Arkansas *Algebra I Mathematics Curriculum Framework* are interrelated, in many cases there are other item correlations or associations across Strands, Content Standards, and Student Learning Expectations.

Parts V and VI of the Released Item Booklet contain a tabular listing of the Strand, Content Standard, and Student Learning Expectation that each question was designed to assess. The multiple-choice and open-response items found on the *Algebra I End-of-Course Examinations* 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. Parts V and VI of the Released Item Booklet provide Arkansas educators with specific information on how the *Algebra I End-of-Course Examinations* items align or correlate with the Arkansas *Algebra I Mathematics Curriculum Framework* to provide models for classroom instruction.

PART I Scoring Student Responses to Algebra I Open-Response Items

While multiple-choice items are scored by machine to determine if the student chose the correct answer from four options, responses to open-response items must be scored by trained “readers” using a pre-established set of scoring criteria.

The Arkansas Algebra I Rangefinding Committee assisted in the development of the scoring criteria. The committee comprises active Arkansas educators with expertise in mathematics education.

Reader Training

Before readers are allowed to begin assigning scores to any student responses, they go through intensive training. The first step in that training is for the readers to read the Algebra I open-response items as they appear in the test booklet and to respond—just as the student test takers are required to do. This step gives the readers some insight into how the students might have responded. The next step is the readers’ introduction to the scoring rubric. All of the specific requirements of the rubric are explained by the Scoring Director who has been specifically trained to lead the scoring group. Then responses (anchor papers) that illustrate the score points of the rubric are presented to the readers and discussed. The goal of this discussion is for the readers to understand why a particular response (or type of response) receives a particular score. After discussion of the rubric and anchor papers, readers practice scoring sets of responses that have been pre-scored and selected for use as training papers. Detailed discussion of the responses and the scores they receive follows.

After three or four of these practice sets, readers are given “qualifying rounds.” These are additional sets of pre-scored papers, and, in order to qualify, each reader must score in exact agreement on at least 80% of the responses and have no more than 5% non-adjacent agreement on the responses. Readers who do not score within the required rate of agreement are not allowed to score the *Algebra I End-of-Course Examinations* responses.

Once scoring of the actual student responses begins, readers are monitored constantly throughout the project to ensure that they are scoring according to the criteria. Daily and cumulative statistics are posted and analyzed, and the Scoring Director or Team Leaders reread selected responses scored by the readers. These procedures promote reliable and consistent scoring. Any reader who does not maintain an acceptable level of agreement is dismissed from the project.

Scoring Procedures

All student responses to the *Algebra I End-of-Course Examinations* open-response test items are scored independently by two readers. Those two scores are compared, and responses that receive scores that are non-adjacent (a “1” and a “3,” for example) are scored a third time by a Team Leader or the Scoring Director for resolution.

PART II Mid-Year End-of-Course Released Algebra I Items

1. Simplify the expression below.

$$(5t)(-30t^2)$$

- * A. $-150t^3$
- B. $150t^3$
- C. $-25t^3$
- D. $-6t$

2. What is the factored form of the polynomial below?

$$6x^2 + 5x - 4$$

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

3. Mrs. Plummer teaches third grade. At recess one day, Mrs. Plummer notices that her six tallest students are the only ones wearing hats. Which statement would be an example of Mrs. Plummer confusing correlation with causation?

- A. The taller students are wearing hats today.
- B. The shorter students are not wearing hats today.
- * C. Being tall increases the chances of wearing a hat.
- D. Some students wore hats today and some did not.

4. Angela was supposed to graph the equation $y = \frac{3}{5}x + 12$, but she misread the problem and graphed $y = \frac{3}{5}x + 2$. How will her graph compare to the **correct** graph?

- A. It will be flatter.
- B. It will be steeper.
- * C. It will be 10 units lower.
- D. It will go down instead of up.

5. What is the simplified form of the expression below?

$$\sqrt{4} + 2\sqrt{3} - \sqrt{4}$$

- * A. $2\sqrt{3}$
- B. $2\sqrt{7}$
- C. $\sqrt{4} + 2\sqrt{3}$
- D. $2\sqrt{4} + 2\sqrt{3}$

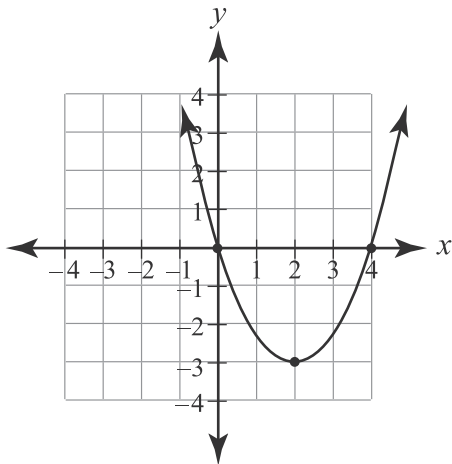
6. If a family tree is traced back n generations, 2^n ancestors, at most, will be found in that generation. At **most**, how many ancestors would be found when tracing back 8 generations?

- A. 8
- B. 16
- C. 64
- * D. 256

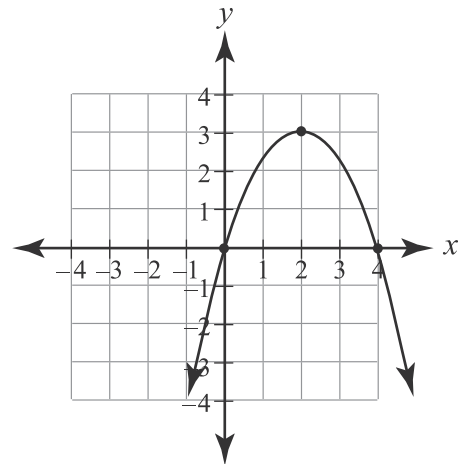
PART II Mid-Year End-of-Course Released Algebra I Items

7. Which graph has a minimum and vertex at $(2, -3)$ and zeros of $(0, 0)$ and $(4, 0)$?

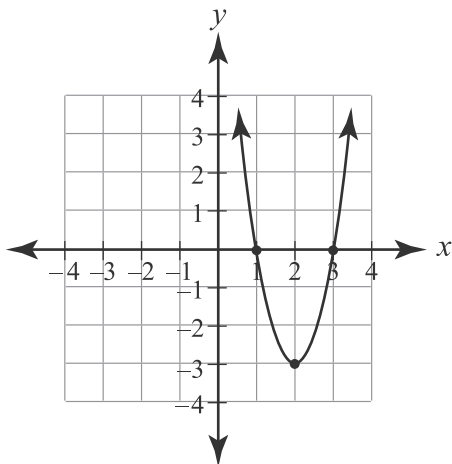
* A.



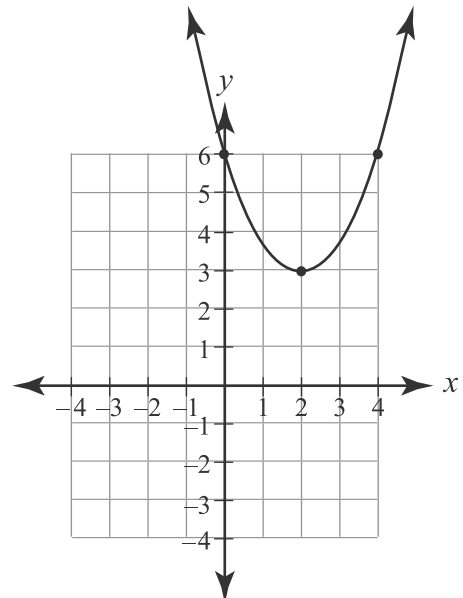
B.



C.



D.



8. What are the next two terms of the pattern shown below?

55, 42, 31, 22, 15, ____, ____

- A. 7, 6
- B. 8, 3
- C. 10, 6
- * D. 10, 7

9. Beau charges a \$10 base fee plus \$5 per hour to mow yards. Jaime charges a \$12 base fee plus \$4.50 per hour. At what time will Beau and Jaime be charging the same total fee?

- A. 0.2 hours
- B. 1 hour
- * C. 4 hours
- D. never

PART II Mid-Year End-of-Course Released Algebra I Items

10. Billy has 20 pennies in his pocket. Billy does not realize that there is a hole in his pocket and 2 pennies fall out for every block he walks. A graph is made showing the number of pennies, y , that are left after Billy has walked x blocks. What is the slope of the graph?

- A. $-\frac{1}{10}$
- * B. -2
- C. -10
- D. -20

11. It took Frances 10 minutes to read the first 14 pages of her English assignment. If she continues to read at the same rate, how long will it take her to read the remaining 22 pages, to the nearest minute?

- A. 15 minutes
- * B. 16 minutes
- C. 18 minutes
- D. 31 minutes

12. Given the function $f(x) = 2 - 4x$, what is $f(-2)$?

- A. -6
- B. 1
- C. 4
- * D. 10

13. There are three brands of fertilizers that provide different levels of three minerals that a gardener might need.

- Brand X has 6 parts Mineral A, 2 parts Mineral B, and 1 part Mineral C.
- Brand Y has 2 parts Mineral A, 1 part Mineral B, and 2 parts Mineral C.
- Brand Z has 1 part Mineral A, 3 parts Mineral B, and 6 parts Mineral C.

Which matrix shows how much of each mineral is provided by each brand?

A.
$$\begin{matrix} & \begin{matrix} A & B & C \end{matrix} \\ \begin{matrix} X \\ Y \\ Z \end{matrix} & \begin{bmatrix} 6 & 2 & 1 \\ 2 & 1 & 3 \\ 1 & 2 & 6 \end{bmatrix} \end{matrix}$$

* B.
$$\begin{matrix} & \begin{matrix} A & B & C \end{matrix} \\ \begin{matrix} X \\ Y \\ Z \end{matrix} & \begin{bmatrix} 6 & 2 & 1 \\ 2 & 1 & 2 \\ 1 & 3 & 6 \end{bmatrix} \end{matrix}$$

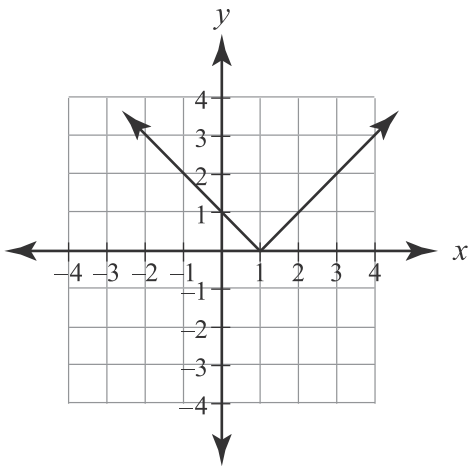
C.
$$\begin{matrix} & \begin{matrix} A & B & C \end{matrix} \\ \begin{matrix} X \\ Y \\ Z \end{matrix} & \begin{bmatrix} 6 & 2 & 1 \\ 1 & 3 & 6 \\ 2 & 1 & 2 \end{bmatrix} \end{matrix}$$

D.
$$\begin{matrix} & \begin{matrix} A & B & C \end{matrix} \\ \begin{matrix} X \\ Y \\ Z \end{matrix} & \begin{bmatrix} 1 & 3 & 6 \\ 6 & 2 & 1 \\ 2 & 1 & 2 \end{bmatrix} \end{matrix}$$

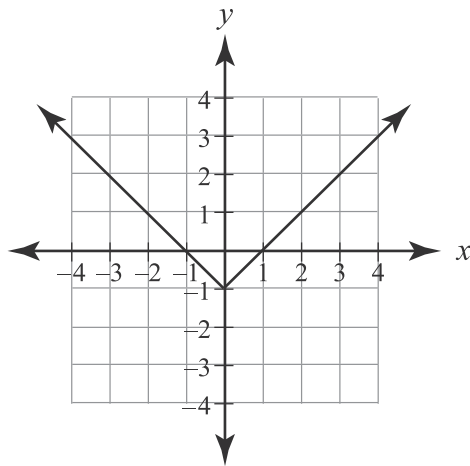
PART II Mid-Year End-of-Course Released Algebra I Items

14. Which is the graph of $f(x) = |x| - 1$ shifted up 2 units?

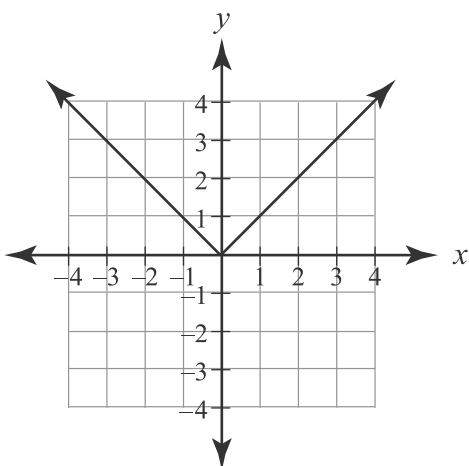
A.



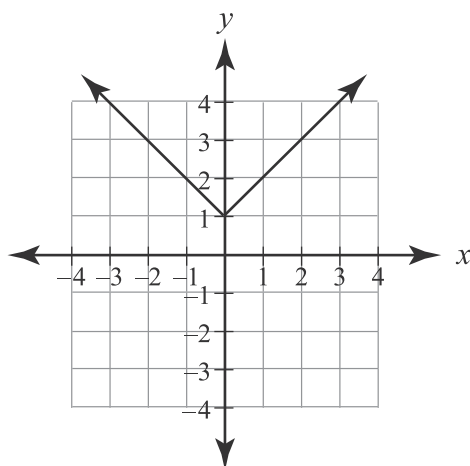
B.



C.



* D.



15. Brad has \$80 and is paid \$20 for every lawn he mows. His friend Trevor has \$200 but is not earning or losing any money. Which inequality can be solved for the number of lawns, x , that Brad must mow in order to have more money than Trevor?

- A. $80x + 20 < 200$
- B. $80x + 20 > 200$
- C. $80 + 20x < 200$
- * D. $80 + 20x > 200$

16. If the equations $y = 3x + 6$ and $y = 3x - 6$ were graphed on the same coordinate grid, how would the two lines relate to one another?

- * A. They would be parallel.
- B. They would be vertical.
- C. They would be intersecting.
- D. They would be perpendicular.

PART II Mid-Year End-of-Course Released Algebra I Items

17. Which table relates to a linear function?

- * A.

x	y
1	-2
2	-4
3	-6
4	-8

 B.

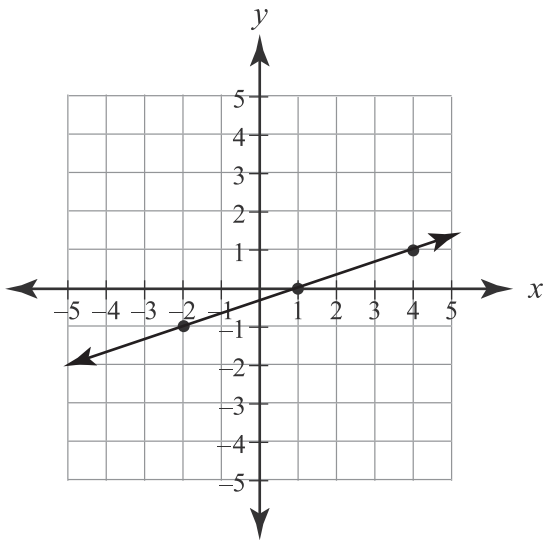
x	y
1	-2
2	0
3	4
4	12
- C.

x	y
1	2
2	3
3	4
4	7

 D.

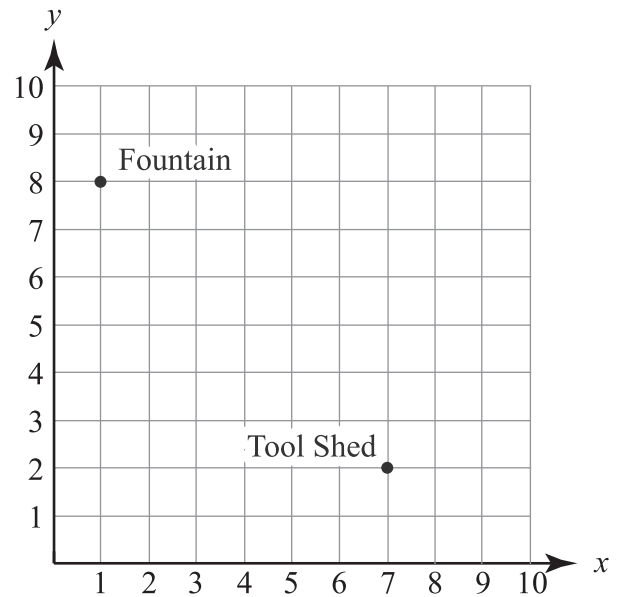
x	y
1	3
2	6
3	8
4	12

18. What is the slope of the line given in the graph below?



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

19. Christa is landscaping her backyard. She makes a map of it on a coordinate grid to help plan her design, as shown below.



The fountain is located at (1, 8), and the tool shed is at (7, 2). Christa wants to put a bird feeder halfway between the fountain and the tool shed. At what coordinates should Christa place the bird feeder?

- * A. (4, 5)
 B. (5, 4)
 C. (6, 6)
 D. (8, 10)

20. What is $\sqrt{\frac{64}{16}}$ expressed in simplest form?

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

PART II Mid-Year End-of-Course Released Algebra I Items

21. Jessica has a bag that contains 4 red marbles, 5 blue marbles, and 6 green marbles. If Jessica picks a marble at random, what is the probability that it is green?

- A. $\frac{1}{6}$
- * B. $\frac{2}{5}$
- C. $\frac{2}{3}$
- D. $\frac{5}{2}$

22. Katie heard her math teacher tell the class, "The grade you get on the next test will be directly proportional to the amount you study." Katie knows that her friend Jane studied for 5 hours and earned a 78%. Katie studied for 6 hours. If what the teacher said is true, what was Katie's test grade, to the nearest percent?

- A. 79%
- B. 84%
- * C. 94%
- D. 98%

23. What values of x will satisfy the equation below?

$$x^2 - 12x + 27 = 0$$

- A. 6 and 18
- B. 27 and 1
- C. 9 and -3
- * D. 3 and 9

24. What is the simplest form of the expression below?

$$\frac{10x^4 + 50x^3}{2x^3}, \text{ if } x \neq 0$$

- A. $5x^4 + 25x^3$
- * B. $5x + 25$
- C. $8x + 48$
- D. $5x$

25. The senior class is ordering T-shirts. The printing company charges a \$45 design fee plus \$7.50 per shirt. Which equation represents the total cost, C , for ordering s shirts?

- A. $s = \$45.00C + \7.50
- B. $s = \$7.50C + \45.00
- C. $C = \$45.00s + \7.50
- * D. $C = \$7.50s + \45.00

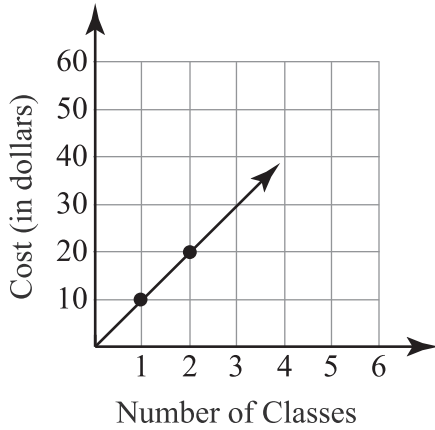
26. A survey is taken to find the attitudes of people toward a tax increase that would pay for street repairs. Which should be included as a question on the survey?

- A. How big of a tax increase should we pass to pay for street repairs?
- * B. Do you support a tax increase that will provide money for street repairs?
- C. Are you willing to increase taxes to pay for repairs on our terribly run down streets?
- D. Considering how high taxes already are, would you put up with another tax increase to pay for street repairs?

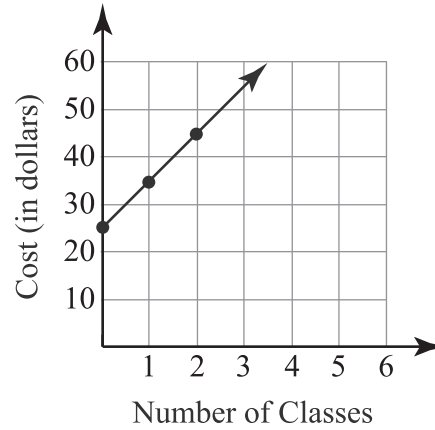
PART II Mid-Year End-of-Course Released Algebra I Items

27. It costs \$25 to attend a dance school plus \$10 for each different type of dance class taken. Which graph represents the cost of taking classes at the school?

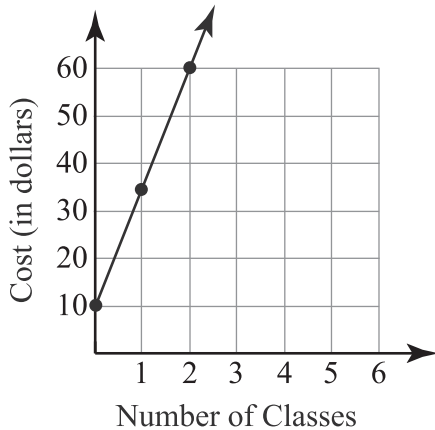
A.



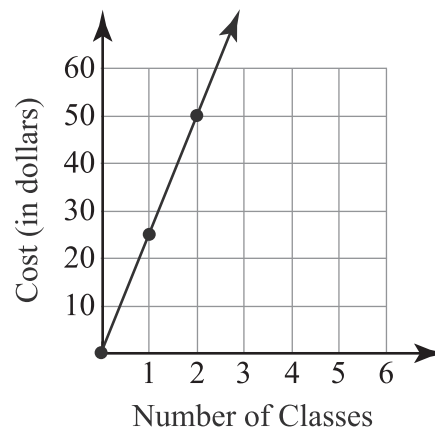
* B.



C.



D.



28. What values of d are solutions of the equation below?

$$|3d| - 6 = 24$$

- A. $d = 2, d = -2$
- B. $d = 6, d = -6$
- * C. $d = 10, d = -10$
- D. $d = 14, d = -14$

29. Bob budgets enough money to build a rectangular deck that is 450 square feet. He wants the deck's length to be twice its width. What will be the dimensions of the deck, rounded to the nearest foot?

- * A. 15 ft \times 30 ft
- B. 18 ft \times 25 ft
- C. 20 ft \times 40 ft
- D. 21 ft \times 22 ft

PART II Mid-Year End-of-Course Released Algebra I Items

30. Andy can maintain a speed of 15 miles per hour on his bicycle. How long will it take him to finish a 60-mile bicycle race?

- A. $\frac{1}{4}$ hours
- * B. 4 hours
- C. 45 hours
- D. 900 hours

31. What is the simplest form of the expression below?

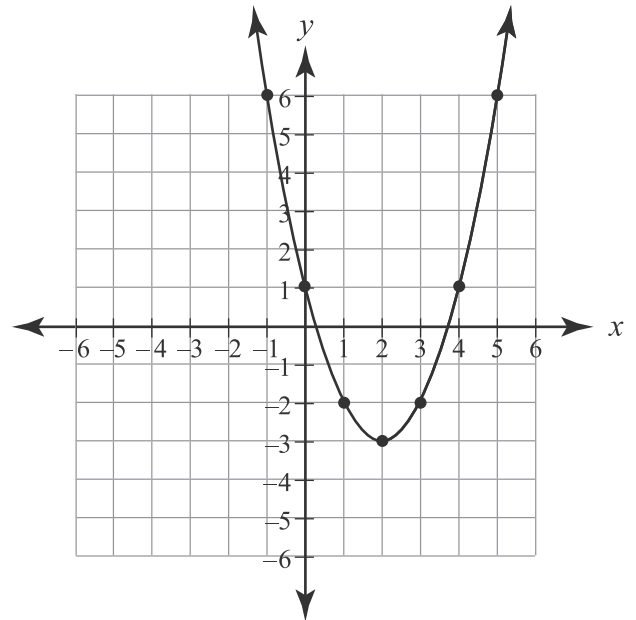
$$-2x(x^2 + 2x)$$

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

32. What is the value of the expression $\frac{4x^2 + 2x}{x - 3}$ when $x = 3$?

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

33. Below is the graph of $y = x^2 - 4x + 1$.

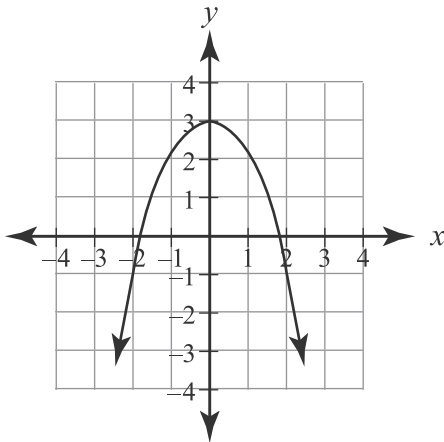


What is the vertex?

- A. (0, 1)
- * B. (2, -3)
- C. (3.75, 0)
- D. (0.25, 0)

PART III End-of-Course Released Algebra I Items

1. What is the vertex of the graph below?



- A. (0, 1)
 * B. (0, 3)
 C. (1, 0)
 D. (3, 0)
2. Which set of ordered pairs is a function?
- * A. $\{(2, -5), (-3, -5), (-4, -5), (-5, 5)\}$
 B. $\{(4, -2), (-1, -3), (0, -6), (4, -1)\}$
 C. $\{(7, 3), (-7, -2), (7, 2), (-6, -1)\}$
 D. $\{(6, 0), (0, 6), (6, 1), (1, 6)\}$
3. What is the value of m in the equation below?

$$2m + 1 = 3m + 4(m - 1)$$

- A. $m = -\frac{3}{5}$
 B. $m = 0$
 C. $m = \frac{2}{9}$
 * D. $m = 1$

4. Eldon's Plumbing Inc. charges \$35 for a service call, plus \$20 per hour of work. An equation is written giving the cost, y , of a service call that lasts x hours. What is the slope of the line given by the equation?

- A. 15
 * B. 20
 C. 35
 D. 55

5. Which expresses the operation below in scientific notation?

0.0016 divided by 400,000

- * A. 4×10^{-9}
 B. 4×10^{-8}
 C. 4×10^{-7}
 D. 4×10^2
6. Central Heights High School requires its students to eat lunch at school. The principal wants to survey the students to find out how many are interested in an open-lunch policy that would allow the students to leave the school grounds. Which sampling method would provide the **most** accurate results?
- A. Survey students in the Honors Calculus class.
 * B. Survey every fifth student leaving the lunch room.
 C. Survey the students in the stands at the next home baseball game.
 D. Survey students at the local mall for one hour immediately after school.

PART III End-of-Course Released Algebra I Items

7. In a vacuum chamber on Earth, the equation $d = 4.9t^2$ gives the distance, d , in meters, that an object will drop in t seconds. To the nearest tenth of a second, how long will it take an object to drop 6 meters?

- * A. 1.1 seconds
- B. 1.2 seconds
- C. 4.9 seconds
- D. 176.4 seconds

8. Henry read the newspaper headline below and decided that he should start drinking coffee because he will then get a job.

Survey Shows 94% of Coffee Drinkers Are Employed

Which statement is true about Henry's reasoning?

- A. Henry is completely correct.
- * B. Henry is confusing correlation with causation.
- C. Henry has it backwards; if he gets a job, then he will drink coffee.
- D. Henry will only be likely to get a job because only 94% are employed.

9. Given the function $f(x) = 2x + 7$, what is $f(1)$?

- A. $-\frac{7}{2}$
- B. -3
- * C. 9
- D. 10

10. Which value is in the solution set of $|x| - 2 \leq 3$?

- A. $x = -9$
- B. $x = -6$
- * C. $x = 0$
- D. $x = 7$

11. Ten students were asked by their instructor to record the number of hours they spent studying for a given exam from the time the exam was announced in class. The data values, in hours, were recorded below.

12 15 8 9 14 8 17 14 8 15

The median number of hours spent studying for this sample is 13. The instructor forgot to record two other students' study time. He found out that one student studied for 11 hours and the other student studied for 16 hours. What is now the **correct** median?

- A. 11
- B. 12
- * C. 13
- D. 14

12. Evaluate the expression below, if $a = 19$, $b = 4$, and $c = 2$.

$$c + (3b)b + c(a - 6)$$

- A. 28
- * B. 76
- C. 92
- D. 676

PART III End-of-Course Released Algebra I Items

13. What is the simplified form of the fraction below?

$$\frac{5}{\sqrt{3}}$$

- A. $\frac{\sqrt{15}}{3}$
- B. $\sqrt{5}$
- C. $\frac{5}{\sqrt{15}}$
- * D. $\frac{5\sqrt{3}}{3}$

14. In an electrical transformer, the voltage is directly proportional to the number of turns on the coil. If 100 volts comes from 60 turns, what would be the voltage produced by 55 turns?

- A. 1.67 volts
- * B. 91.67 volts
- C. 95.00 volts
- D. $109.\overline{09}$ volts

15. Which recursive formula shows how to determine the next three terms in the sequence below?

3, 6, 9, 12, 15, _____, _____, _____

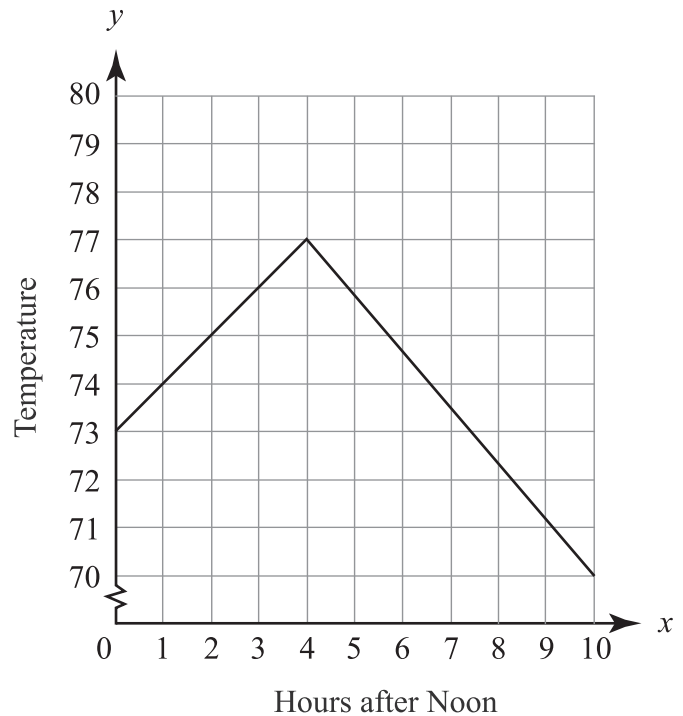
- * A. $a_1 = 3, a_n = a_{n-1} + 3$
- B. $a_1 = 6, a_n = a_{n-1} + 6$
- C. $a_1 = 9, a_n = a_{n-1} + 9$
- D. $a_1 = 12, a_n = a_{n-1} + 12$

16. What is the simplest form of the expression below?

$$(4\sqrt{6})(\sqrt{3})$$

- A. 12
- B. 27
- C. $7\sqrt{2}$
- * D. $12\sqrt{2}$

17. Which statement is true for the graph below?



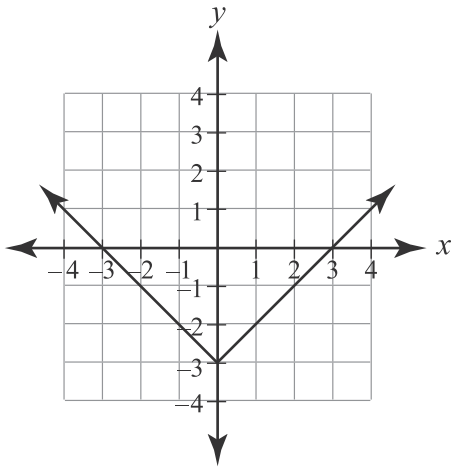
- A. The hours are the dependent variable.
- * B. The hours are the independent variable.
- C. The temperature is the independent variable.
- D. Either temperature or hours can be the dependent variable.

PART III End-of-Course Released Algebra I Items

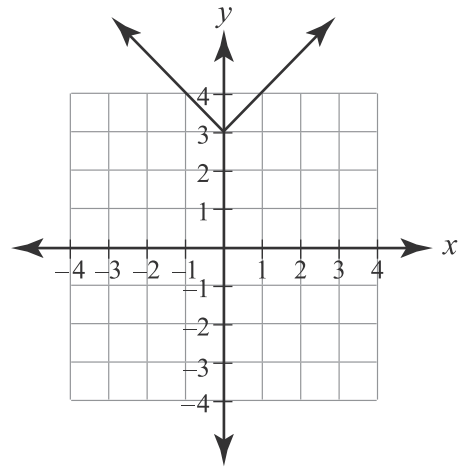
18. Which is the graph of the equation below?

$$y = |x| - 3$$

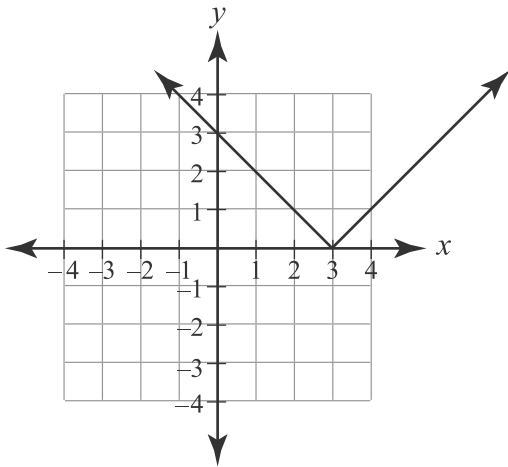
* A.



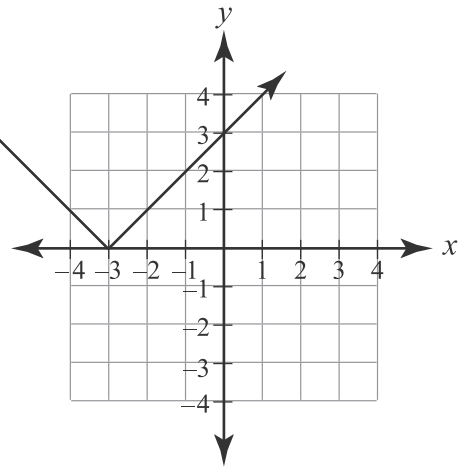
B.



C.



D.



19. What is the solution to the system of equations below?

$$\begin{aligned} 3x + 2y &= 6 \\ 3x + 6y &= 18 \end{aligned}$$

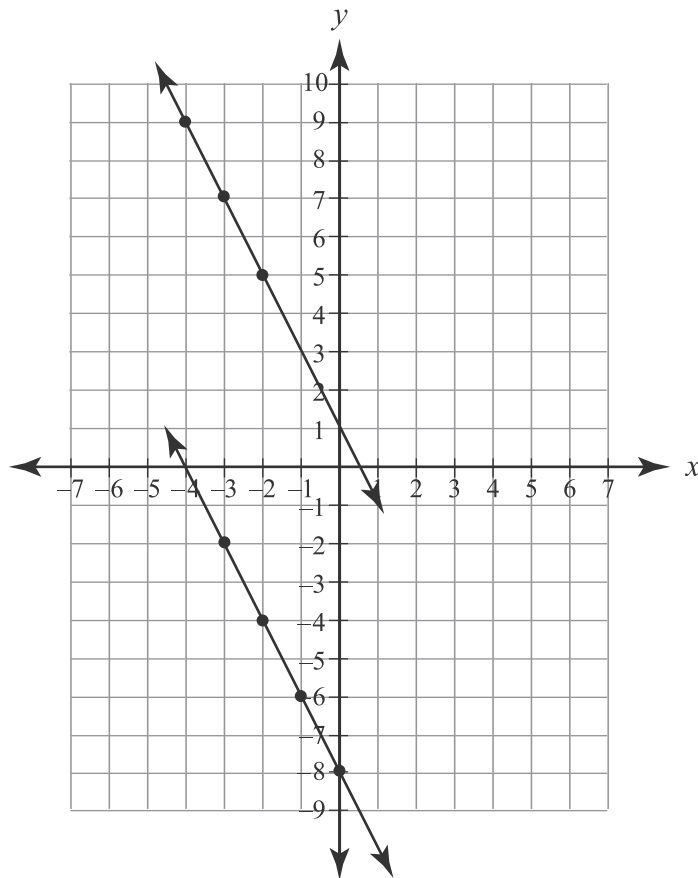
- * A. (0, 3)
- B. (0, 6)
- C. (1, 2)
- D. (3, 0)

20. Which expression is undefined?

- A. 4^0
- B. $\frac{x}{4}$
- C. $\frac{0}{4}$
- * D. $\frac{4}{0}$

PART III End-of-Course Released Algebra I Items

21. What do the two lines in the graph below have in common?



- * A. the same slope
- B. the same y -intercepts
- C. the same solution sets
- D. the same tables of data

22. What is the factored form of the expression below?

$$9x^2 - 16$$

- A. $(9x - 4)(x + 4)$
- B. $(3x - 4)(3x - 4)$
- * C. $(3x + 4)(3x - 4)$
- D. $(3x - 16)(3x + 1)$

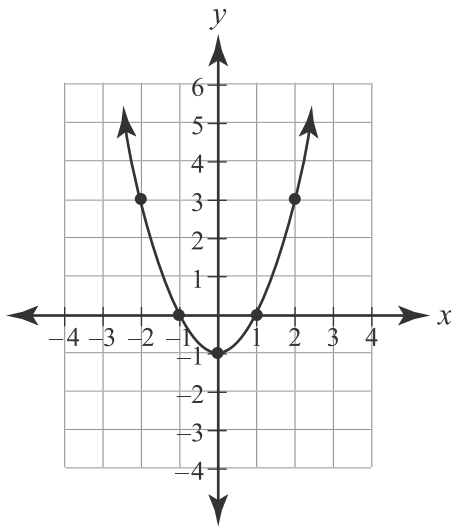
23. Which **correctly** solves the equation $ab + c = d$ for b ?

- A. $b = d - a - c$
- B. $b = a(d - c)$
- C. $b = \frac{d}{a} - c$
- * D. $b = \frac{d - c}{a}$

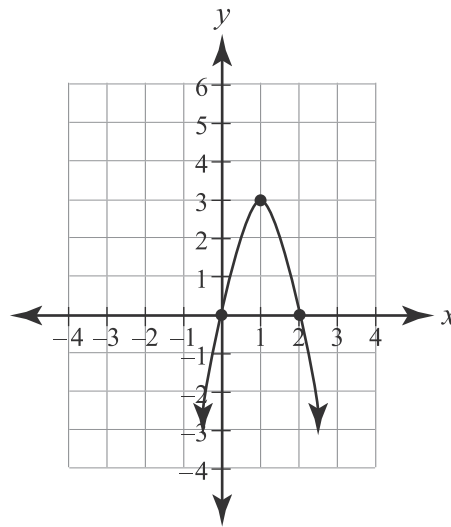
PART III End-of-Course Released Algebra I Items

24. Which graph has a vertex of (0, 1) and no zeros?

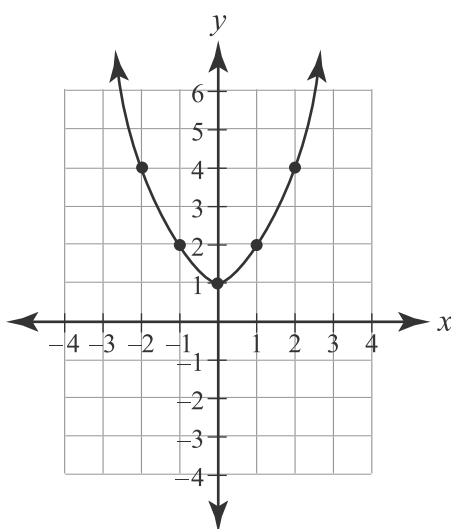
A.



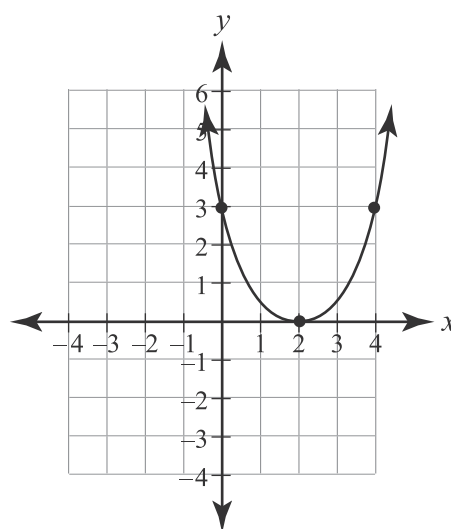
B.



*C.



D.



25. What is the simplest form of the expression below?

$$\frac{14x^2(x+3x^5)}{7x^2}, \text{ if } x \neq 0$$

- A. $x + 3x^5$
- *B. $2x + 6x^5$
- C. $7x + 21x^5$
- D. $2x^3 + 42x^7$

26. What is the domain of the relation below?

$$\{(3, 8), (4, 10), (5, 12), (6, 14)\}$$

- A. {3}
- B. {6}
- *C. {3, 4, 5, 6}
- D. {8, 10, 12, 14}

PART III End-of-Course Released Algebra I Items

27. The management of a company was examining the salaries of their employees. Below is a cumulative frequency histogram of the salaries of all 25 employees.



Which statement **best** represents the information in the histogram?

- A. The salaries are evenly distributed.
- B. All employees make \$70,000 or less.
- C. Everyone makes pretty much the same salary.
- * D. Most of the salaries fall between \$40,000 and \$59,000.

28. Mrs. Walker earned \$212 for working $8\frac{1}{2}$ hours. At this rate, how much should she expect to earn for working 16 hours? Round your answer to the nearest whole dollar.

- A. \$120
- B. \$136
- * C. \$399
- D. \$424

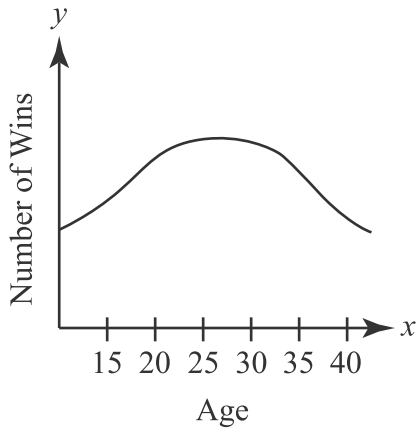
29. Drew has \$72 for new school clothes. He spends \$28 on a pair of jeans. Which inequality indicates how much more Drew can spend on school clothes and stay within his limit?

- A. $28 + 72 \leq s$
- * B. $28 + s \leq 72$
- C. $28 + 72 \geq s$
- D. $s \leq 72$

PART III End-of-Course Released Algebra I Items

30. What can be determined from the graph below?

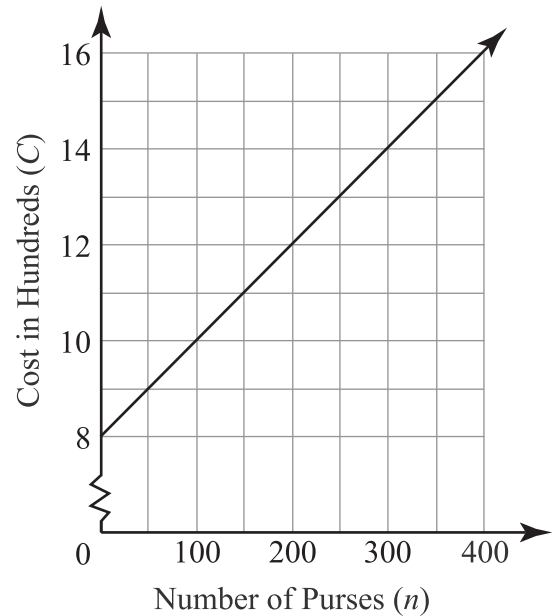
Number of Wins vs Player Age



- A. All players aged 35 will win the most matches.
 - B. The older a player is, the more likely he is to win.
 - C. Players in their early 20s win more than players in their early 30s.
 - * D. Players in their late 20s win more than players in their late teens.
31. A bag of marbles contains 6 red, 6 white, and 3 blue marbles. The first marble that is drawn out of the bag is white. Without replacing it, a second marble is drawn and it is blue. Neither marble is replaced. What is the probability that the third marble drawn will be red?

- A. $\frac{4}{125}$
- B. $\frac{1}{6}$
- C. $\frac{6}{15}$
- * D. $\frac{6}{13}$

32. The cost, C , per week of producing n purses for the Chic Girl Purse Company is graphed below.



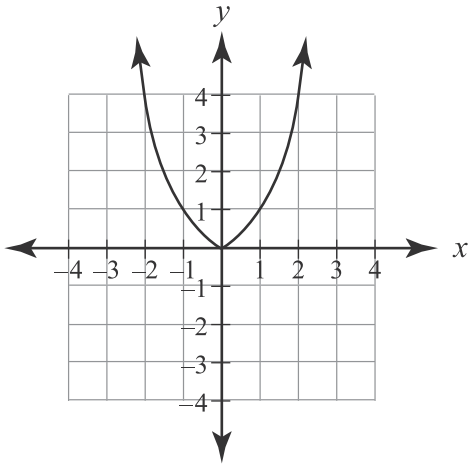
What is the cost of producing 275 purses?

- A. \$1,200
- B. \$1,300
- * C. \$1,350
- D. \$1,400

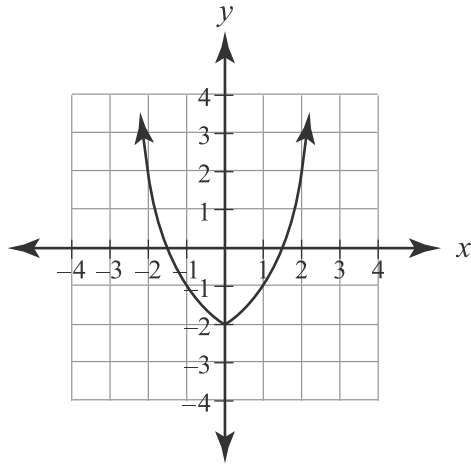
PART III End-of-Course Released Algebra I Items

33. Which is the graph of $f(x) = x^2 - 2$ with an upward vertical shift of 2 units?

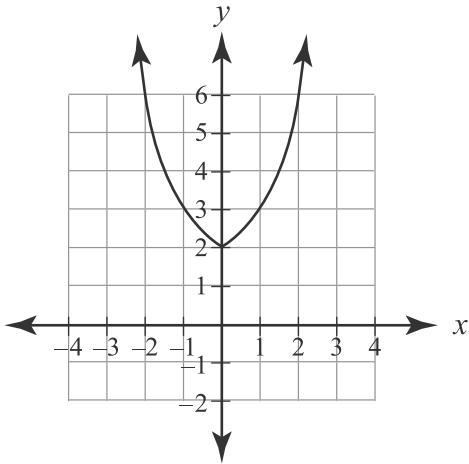
* A.



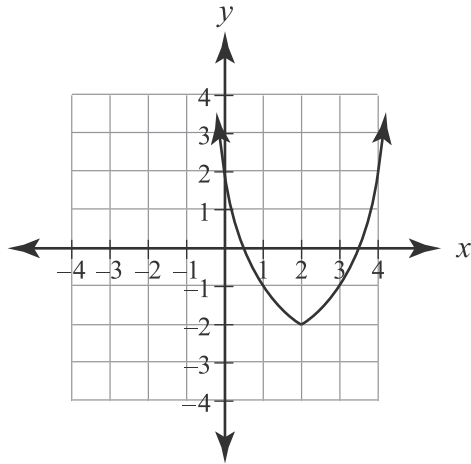
B.



C.

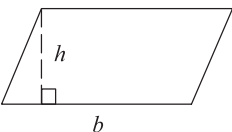
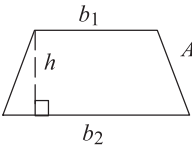
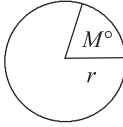
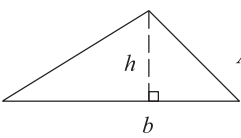
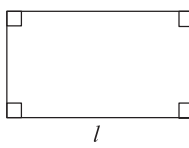
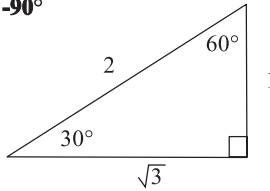
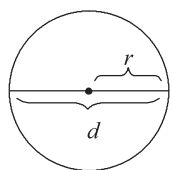
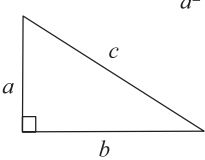
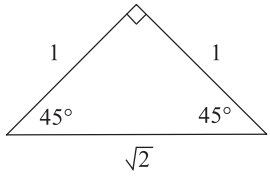
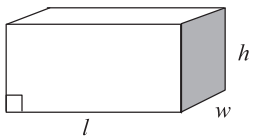
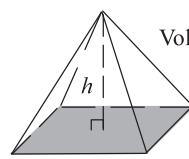
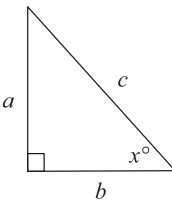
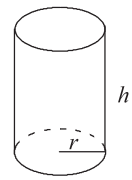
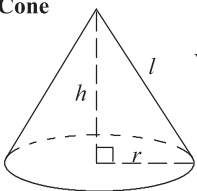
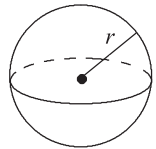


D.



PART III Mid-Year and End-of-Course Mathematics Reference Sheet

End-of-Course Mathematics Reference Sheet

Parallelogram  $P =$ sum of all sides $A = bh$	Trapezoid  $A = \frac{h(b_1 + b_2)}{2}$	Arc and Sector  Arc Length = $\left(\frac{M}{360}\right) \times 2\pi r$ Sector area = $\left(\frac{M}{360}\right) \times \pi r^2$
Triangle  $P =$ 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  $B =$ 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  $l =$ 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	$A = \frac{s^2\sqrt{3}}{4}$ $s =$ length of a side
	Distance	rate \times time
	Interest	principal \times rate \times 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 $m =$ 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	

PART IV Curriculum Framework

The Arkansas Algebra I Mathematics Curriculum Framework*

Strands	Content Standards	Student Learning Expectations
1. LANGUAGE OF ALGEBRA (LA)	1. Students will develop the language of algebra including specialized vocabulary, symbols, and operations.	<ol style="list-style-type: none"> 1. Evaluate algebraic expressions, including radicals, by applying the order of operations. 2. Translate word phrases and sentences into expressions, equations, and inequalities, and vice versa. 3. Apply the laws of (integral) exponents and roots. 4. Solve problems involving scientific notation, including multiplication and division. 5. Perform polynomial operations (addition, subtraction, multiplication) with and without manipulatives. 6. Simplify algebraic fractions by factoring. 7. Recognize when an expression is undefined. 8. Simplify radical expressions such as $\frac{3}{\sqrt{7}}$. 9. Add, subtract, and multiply simple radical expressions like $3\sqrt{20} + 7\sqrt{5}$ and $4\sqrt{5} * 2\sqrt{3}$.
2. SOLVING EQUATIONS AND INEQUALITIES (SEI)	2. Students will write, with and without appropriate technology, equivalent forms of equations, inequalities, and systems of equations, and solve with fluency.	<ol style="list-style-type: none"> 1. Solve multi-step equations and inequalities with rational coefficients <ul style="list-style-type: none"> • numerically (from a table or guess and check) • algebraically (including the use of manipulatives) • graphically • technologically 2. Solve systems of two linear equations <ul style="list-style-type: none"> • numerically (from a table or guess and check) • algebraically (including the use of manipulatives) • graphically • technologically 3. Solve linear formulas and literal equations for a specified variable. (Ex. Solve for p in $l = prt$.) 4. Solve and graph simple absolute value equations and inequalities. (Ex. $x = 5$, $x \leq 5$, $x > 5$) 5. Solve real-world problems that involve a combination of rates, proportions, and percents. 6. Solve problems involving direct variation and indirect (inverse) variation to model rates of change. 7. Use coordinate geometry to represent and/or solve problems (midpoint, length of a line segment, and Pythagorean Theorem). 8. Communicate real-world problems graphically, algebraically, numerically, and verbally.
3. LINEAR FUNCTIONS (LF)	3. Students will analyze functions by investigating rates of change, intercepts, and zeros.	<ol style="list-style-type: none"> 1. Distinguish between functions and non-functions/relations by inspecting graphs, ordered pairs, mapping diagrams, and/or tables of data. 2. Determine domain and range of a relation from an algebraic expression, graphs, set of ordered pairs, or table of data. 3. Know and/or use function notation, including evaluating functions for given values in their domain. 4. Identify independent variables and dependent variables in various representational modes: words, symbols, and/or graphs. 5. Interpret the rate of change/slope and intercepts within the context of everyday life. [Ex. telephone charges based on base rate (y-intercept) plus rate per minute (slope)] 6. Calculate the slope given <ul style="list-style-type: none"> • two points • the graph of a line • the equation of a line 7. Determine, by using slope, whether a pair of lines are parallel, perpendicular, or neither. 8. Write an equation in slope-intercept, point-slope, and standard forms, given <ul style="list-style-type: none"> • two points • a point and y-intercept • x-intercept and y-intercept • a point and slope • a table of data • the graph of a line 9. Describe the effects of parameter changes, slope, and/or y-intercept, on graphs of linear functions and vice versa.

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

PART IV Curriculum Framework

The Arkansas Algebra I Mathematics Curriculum Framework* (continued)

Strands	Content Standards	Student Learning Expectations
4. NON-LINEAR FUNCTIONS (NLF)	4. Students will compare the properties in the family of functions.	<ol style="list-style-type: none"> 1. Factoring polynomials. <ul style="list-style-type: none"> • greatest common factor • binomials (difference of squares) • trinomials 2. Determine minimum, maximum, vertex, and zeros, given the graph. 3. Solve quadratic equations using the appropriate methods with and without technology. <ul style="list-style-type: none"> • factoring • quadratic formula with real-number solutions 4. Recognize function families and their connections, including vertical shift and reflection over the x-axis. <ul style="list-style-type: none"> • quadratics (with rational coefficients) • absolute value • exponential functions 5. Communicate real-world problems graphically, algebraically, numerically, and verbally.
5. DATA INTERPRETATION AND PROBABILITY (DIP)	5. Students will compare various methods of reporting data to make inferences or predictions.	<ol style="list-style-type: none"> 1. Construct and use scatter plots and line of best fit to make inferences in real-life situations. 2. Use simple matrices in addition, subtraction, and scalar multiplication. 3. Construct simple matrices for real-life situations. 4. Determine the effects of changes in the data set on the measures of central tendency. 5. Use two or more graphs (i.e., box-and-whisker, histograms, scatter plots) to compare data sets. 6. Construct and interpret a cumulative frequency histogram in real-life situations. 7. Recognize linear functions and non-linear functions by using a table or a graph. 8. Compute simple probability with and without replacement. 9. Recognize patterns using explicitly defined and recursively defined linear functions. 10. Communicate real-world problems graphically, algebraically, numerically, and verbally. 11. Explain how sampling methods, bias, and phrasing of questions in data collection impact the conclusions. 12. Recognize when arguments based on data confuse correlation with causation.

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

PART V Mid-Year End-of-Course Item Correlation with Curriculum Framework

Released Items for Mid-Year End-of Course Algebra I*

Strands	Content Standards
1— Language of Algebra (LA)	1. Students will develop the language of algebra including specialized vocabulary, symbols, and operations.
2— Solving Equations and Inequalities (SEI)	2. Students will write, with and without appropriate technology, equivalent forms of equations, inequalities, and systems of equations, and solve with fluency.
3— Linear Functions (LF)	3. Students will analyze functions by investigating rates of change, intercepts, and zeros.
4— NON-LINEAR FUNCTIONS (NLF)	4. Students will compare the properties in the family of functions.
5— DATA INTERPRETATION AND PROBABILITY (DIP)	5. Students will compare various methods of reporting data to make inferences or predictions.

Item	Strand	Content Standard	Student Learning Expectation
1	LA	1	3
2	NLF	4	1
3	DIP	5	12
4	LF	3	9
5	LA	1	9
6	NLF	4	5
7	NLF	4	2
8	DIP	5	9
9	SEI	2	8
10	LF	3	5
11	SEI	2	5
12	LF	3	3
13	DIP	5	3
14	NLF	4	4
15	LA	1	2
16	LF	3	7
17	DIP	5	7
18	LF	3	6
19	SEI	2	7
20	LA	1	8
21	DIP	5	8
22	SEI	2	6
23	NLF	4	3
24	LA	1	6
25	LF	3	8
26	DIP	5	11
27	DIP	5	10
28	SEI	2	4
29	NLF	4	5
30	SEI	2	5
31	LA	1	5
32	LA	1	7
33	NLF	4	2

*Only the predominant Strand, Content Standard, and Student Learning Expectation are listed for the Algebra I items.

PART V Mid-Year End-of-Course Item Correlation with Curriculum Framework

Non-Released Items for Mid-Year End-of-Course Algebra I*

Strands	Content Standards
1— Language of Algebra (LA)	1. Students will develop the language of algebra including specialized vocabulary, symbols, and operations.
2— Solving Equations and Inequalities (SEI)	2. Students will write, with and without appropriate technology, equivalent forms of equations, inequalities, and systems of equations, and solve with fluency.
3— Linear Functions (LF)	3. Students will analyze functions by investigating rates of change, intercepts, and zeros.
4— NON-LINEAR FUNCTIONS (NLF)	4. Students will compare the properties in the family of functions.
5— DATA INTERPRETATION AND PROBABILITY (DIP)	5. Students will compare various methods of reporting data to make inferences or predictions.

Item	Strand	Content Standard	Student Learning Expectation
1	LF	3	1
2	LA	1	1
3	SEI	2	1
4	DIP	5	2
5	NLF	4	4
6	DIP	5	1
7	LF	3	2
8	LA	1	2
9	NLF	4	1
10	SEI	2	4
11	LF	3	3
12	DIP	5	4
13	SEI	2	2
14	LF	3	2
15	LA	1	1
16	SEI	2	1
17	DIP	5	5
18	LA	1	4
19	NLF	4	4
20	NLF	4	3
21	LF	3	5
22	SEI	2	2
23	NLF	4	2
24	SEI	2	3
25	LA	1	4
26	DIP	5	6
27	LF	3	4
A	DIP	5	2
B	LF	3	7
C	LA	1	2
D	NLF	4	5
E	SEI	2	8

*Only the predominant Strand, Content Standard, and Student Learning Expectation are listed for the Algebra I items.

PART VI End-of-Course Item Correlation with Curriculum Framework

Released Items for End-of-Course Algebra I*

Strands	Content Standards
1— Language of Algebra (LA)	1. Students will develop the language of algebra including specialized vocabulary, symbols, and operations.
2— Solving Equations and Inequalities (SEI)	2. Students will write, with and without appropriate technology, equivalent forms of equations, inequalities, and systems of equations, and solve with fluency.
3— Linear Functions (LF)	3. Students will analyze functions by investigating rates of change, intercepts, and zeros.
4— NON-LINEAR FUNCTIONS (NLF)	4. Students will compare the properties in the family of functions.
5— DATA INTERPRETATION AND PROBABILITY (DIP)	5. Students will compare various methods of reporting data to make inferences or predictions.

Item	Strand	Content Standard	Student Learning Expectation
1	NLF	4	2
2	LF	3	1
3	SEI	2	1
4	LF	3	5
5	LA	1	4
6	DIP	5	11
7	NLF	4	5
8	DIP	5	12
9	LF	3	3
10	SEI	2	4
11	DIP	5	4
12	LA	1	1
13	LA	1	8
14	SEI	2	6
15	DIP	5	9
16	LA	1	9
17	LF	3	4
18	NLF	4	4
19	SEI	2	2
20	LA	1	7
21	LF	3	9
22	NLF	4	1
23	SEI	2	3
24	NLF	4	2
25	LA	1	6
26	LF	3	2
27	DIP	5	6
28	SEI	2	5
29	LA	1	2
30	DIP	5	10
31	DIP	5	8
32	SEI	2	8
33	NLF	4	4

*Only the predominant Strand, Content Standard, and Student Learning Expectation are listed for the Algebra I items.

PART VI End-of-Course Item Correlation with Curriculum Framework

Non-Released Items for End-of-Course Algebra I*

Strands	Content Standards
1— Language of Algebra (LA)	1. Students will develop the language of algebra including specialized vocabulary, symbols, and operations.
2— Solving Equations and Inequalities (SEI)	2. Students will write, with and without appropriate technology, equivalent forms of equations, inequalities, and systems of equations, and solve with fluency.
3— Linear Functions (LF)	3. Students will analyze functions by investigating rates of change, intercepts, and zeros.
4— NON-LINEAR FUNCTIONS (NLF)	4. Students will compare the properties in the family of functions.
5— DATA INTERPRETATION AND PROBABILITY (DIP)	5. Students will compare various methods of reporting data to make inferences or predictions.

Item	Strand	Content Standard	Student Learning Expectation
1	DIP	5	2
2	LA	1	1
3	DIP	5	1
4	NLF	4	2
5	SEI	2	2
6	LF	3	8
7	SEI	2	4
8	LA	1	4
9	NLF	4	5
10	LF	3	7
11	NLF	4	3
12	LF	3	1
13	DIP	5	3
14	SEI	2	3
15	LF	3	8
16	NLF	4	3
17	DIP	5	5
18	LA	1	3
19	SEI	2	1
20	DIP	5	7
21	LA	1	3
22	LF	3	5
23	LA	1	5
24	NLF	4	1
25	NLF	4	5
26	SEI	2	7
27	LF	3	6
A	DIP	5	8
B	LF	3	6
C	LA	1	4
D	NLF	4	3
E	SEI	2	1

*Only the predominant Strand, Content Standard, and Student Learning Expectation are listed for the Algebra I items

ACTAAP

Arkansas Comprehensive Testing, Assessment, and Accountability Program

DEVELOPED FOR THE ARKANSAS DEPARTMENT OF EDUCATION, LITTLE ROCK, AR 72201