

Arkansas Council of Teachers of Mathematics
Algebra I State Exam Spring 2009

Select the best answer for each of the following questions and mark it on the answer sheet provided. Be sure to read all the answer choices before making your selection. When you are finished with the multiple-choice questions, please attempt the tiebreaker questions.

1. The length of a rectangle is 3 more than twice the width. Which of the following represents the perimeter in terms of the width?

- a) $p = 3w + 3$
- b) $p = 3 + 2w$
- c) $p = 6 + 4w$
- d) $p = 6w + 6$

2. Simplify the following using positive exponents: $\frac{(4\sqrt{24} - 3\sqrt{6})xy^{-4}}{10\sqrt{6}x^{-3}y^{-2}}$

- a) $\frac{2\sqrt{6}x^4}{y^2}$
- b) $\frac{\sqrt{6}x^3}{2y}$
- c) $\frac{x^4}{2y^2}$
- d) $\frac{5\sqrt{6}x^4}{y}$

3. To calculate your monthly cell phone bill, C, you multiply the minutes used, x, by the variable cost, V. Then you add the fixed cost F. Which of the following could be used to determine the minutes used per month?

- a) $C = Vx + F$
- b) $C = Vx - F$
- c) $x = C - F/V$
- d) $x = \frac{C - F}{V}$

4. Determine which option is the following expression in its most simplified form:

- a) 2
 - b) 1
 - c) $\sqrt{2}$
 - d) -1
- $$\frac{\sqrt{2}\left(\frac{\sqrt{2}}{2} - 2\sqrt{2}\right)^2}{9\sqrt{2}}$$

5. A student finds the slope of the line between (14,1) and (18,17). She writes $m = -4$. What mistake did she make?

- a) She added the values instead of subtracting.
- b) She used y-values where she should have used x-values.
- c) She interchanged the x- and y-values.
- d) She did not keep the order of the points the same in the numerator and the denominator.

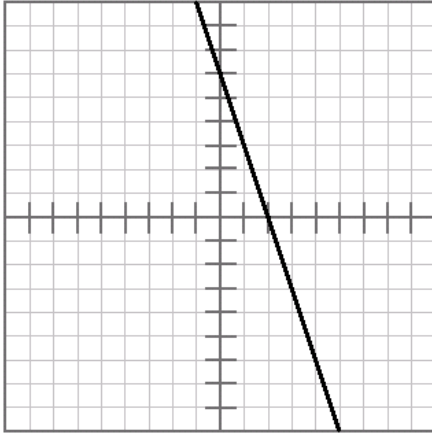
6. If $p > 0$, $d < 0$, and $q < 0$, which of the following will always yield a negative result?

- a) $\frac{p}{dq}$
- b) qpd
- c) $\frac{d^2}{pq}$
- d) $q - (p + d)$

7. Write an equation of a line that is parallel to the line $2x - 5y = 12$ and has same y-intercept as $4y + 24 = 5x$.

- a) $y = \frac{2}{5}x - 6$ b) $y = 6x - \frac{2}{5}$ c) $y = \frac{5}{2}x - 6$ d) $y = \frac{1}{6}x - \frac{5}{2}$

8. The graph of the function $y = -3x + 6$ is shown below.



If the line is translated 3 units down and 4 units to the left, which function will describe the new line?

- a) $y = -3x + 15$
 b) $y = -3x - 1$
 c) $y = -3x + 3$
 d) $y = -3x - 9$

9. What is the equation of the line through the points $(-8, -5)$ and $(-8, -9)$?

- a) $y = -8$
 b) $x = -8$
 c) $x = -4$
 d) $y = 0$

10. Find the x and y intercepts, if possible, of $h(x) = \frac{1}{x} - 2$.

- a) x-int: $(0.5, 0)$
 y-int: $(0, -2)$ b) x-int: $(0.5, 0)$
 y-int: none
 c) x-int: $(0, 0)$
 y-int: $(0, 0)$ d) This function has neither an x-intercept nor a y-intercept.

11. John has an number of dogs represented by x and he has half as many cats as dogs. If he squares the number of cats he has and adds 32 he will get 81. How many dogs does he have?

- a) 7
 b) 14
 c) 18
 d) 28

12. Find the zeros of the function $y = -3x^3 - 7x^2 + 10x$

a) $x = -1, 0, \frac{10}{3}$

b) $x = 1, \frac{10}{3}$

c) $x = -\frac{10}{3}, 0, 1$

d) $x = 0, 1$

13. The zeros of a function are -4, -1, 2, and 5. What is the sum of the factors of the function?

a) $4x - 2$

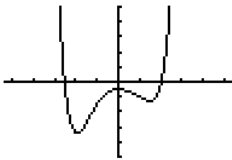
b) 2

c) $4x + 2$

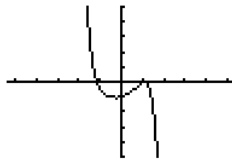
d) $x - 2$

14. Which of the following represents the end behavior of a graph with a negative leading coefficient and an odd degree?

a)



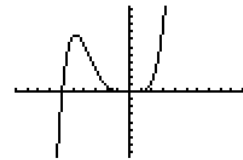
b)



c)



d)



15. What is the maximum number of zeros of the function $q(x) = -2x^2 + 5 + x^3 - 7x$?

a) 2

b) 3

c) 4

d) 5

16. Solve the following system of linear equations:

$$3x - 6y = 18$$

$$4x + 12y = 20$$

a) $x = \frac{28}{5}, y = \frac{1}{5}$

b) $x = 1, y = 4$

c) $x = \frac{28}{5}, y = -\frac{1}{5}$

d) $x = 1, y = 8$

17. If $a = \begin{bmatrix} -2 & 3 \\ 1 & 5 \end{bmatrix}$ and $b = \begin{bmatrix} 4 & -6 \\ 2 & 0 \end{bmatrix}$, what is $2a + 3b$?

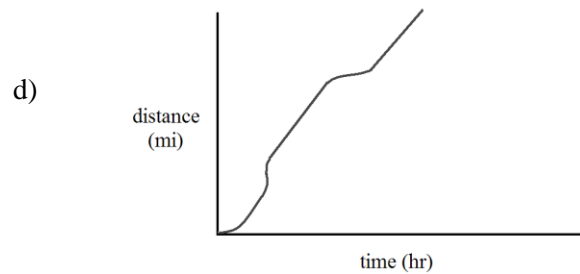
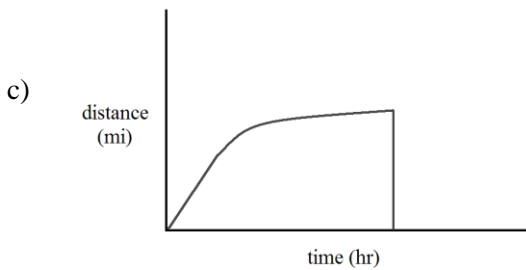
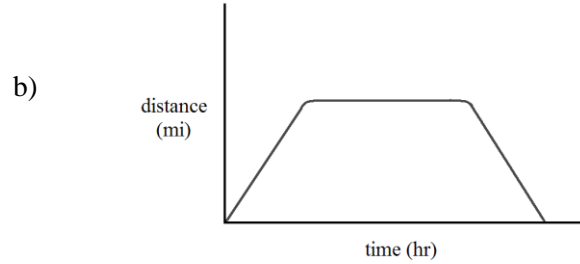
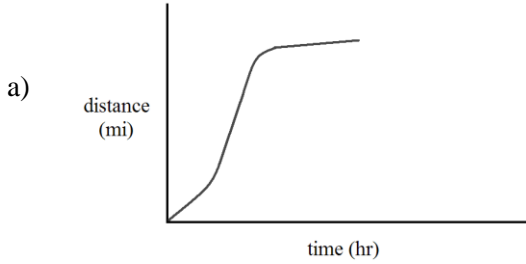
a) $\begin{bmatrix} 8 & -12 \\ 4 & 10 \end{bmatrix}$

b) $\begin{bmatrix} -4 & 6 \\ 2 & 10 \end{bmatrix}$

c) $\begin{bmatrix} 2 & -3 \\ 3 & 5 \end{bmatrix}$

d) $\begin{bmatrix} 8 & -12 \\ 8 & 10 \end{bmatrix}$

18. You are going on a bicycle ride. On the trip you start by gradually speeding up until you reach your desired speed of 15 mph. You stay at that speed until you can see the end of your route. You slow down until you reach the end of your route and stop. Choose the graph that most correctly models your distance over time.



19. Imagine that Tristy's coordinates are $(-5, 5)$, Jane's coordinates are $(6, 5)$, and Liza's coordinates are $(6, 3)$ on a rectangular grid. How much closer is Tristy to Jane than to Liza?

- a) 0.18 feet
- b) 9 feet
- c) 9.18 feet
- d) 11.18 feet

20. The table below shows the test scores of 7 students. The scores are in order from least to greatest.

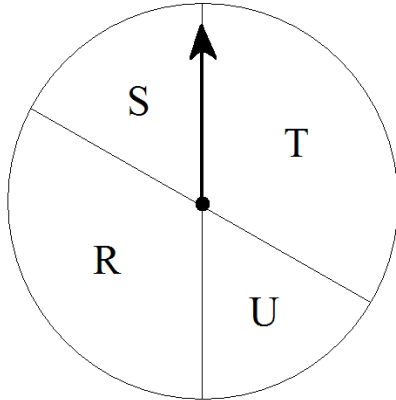
| Student | Score |
|---------|-------|
| Janet | 72 |
| Mark | 75 |
| Luisa | 77 |
| Byron | 81 |
| Ray | 84 |
| Devin | 86 |
| Kamara | 90 |

Which of the following would change the median of the scores?

- a) adding 5 points to Janet's score
- b) adding 5 points to Devin's score
- c) subtracting 5 points from Ray's score
- d) subtracting 5 points from Luisa's score

21. On the spinner below, the sizes of the sections are as follows:

- i. Sections S and U are equal in size
- ii. Sections R and T are equal in size
- iii. The size of section S is half the size of section T.

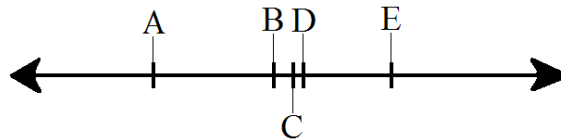


If Darryl spins the arrow one time, what is the probability that it will land on section S?

- a) $\frac{1}{6}$ b) $\frac{1}{4}$ c) $\frac{1}{3}$ d) $\frac{1}{2}$

22. A, B, C, D, and E are values on the following number line that correspond to the numbers

-1 , $-\sqrt{2}$, $-\frac{7}{5}$, -2 , and $-\frac{3}{2}$.



Which number is D?

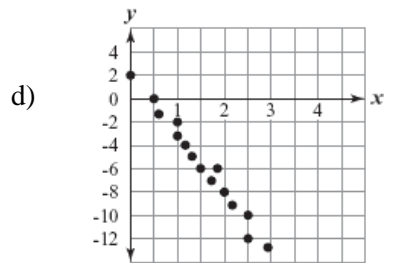
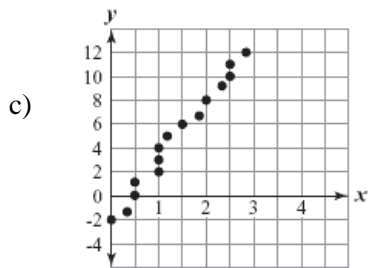
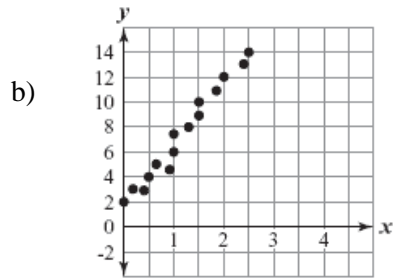
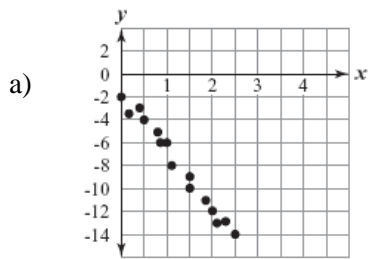
- a) $-\sqrt{2}$ b) $-\frac{7}{5}$ c) $-\frac{3}{2}$ d) -1

23. Solve the following inequality: $\frac{4}{3} \left| x + \frac{3}{2} \right| - 8 \leq 3$

- a) $\left[-\frac{39}{4}, \frac{27}{4} \right]$
 b) $\left(-\infty, \frac{9}{4} \right] \cup \left[\frac{27}{4}, \infty \right)$
 c) $\left[-\frac{97}{6}, \frac{79}{6} \right]$
 d) $\left[\frac{9}{4}, \frac{27}{4} \right]$

24. Which of the following scatter plots is most likely to have a line of best fit represented by the equation below?

$$y = -5x + 2$$



25. Consider the following expression:

$$\frac{1}{16}x^4 - y^4$$

- I. $\frac{1}{2}x - y$
- II. $\frac{1}{8}x^2 - y^2$
- III. $\frac{1}{4}x^2 - y^2$
- IV. $\frac{1}{4}x + y$

Which of the following is true about the factors of the expression?

- a) II and IV are factors
- b) I, III, and IV are factors
- c) I and IV are not factors
- d) I and III are factors

Algebra I Tie Breakers
ACTM State Contest 2009

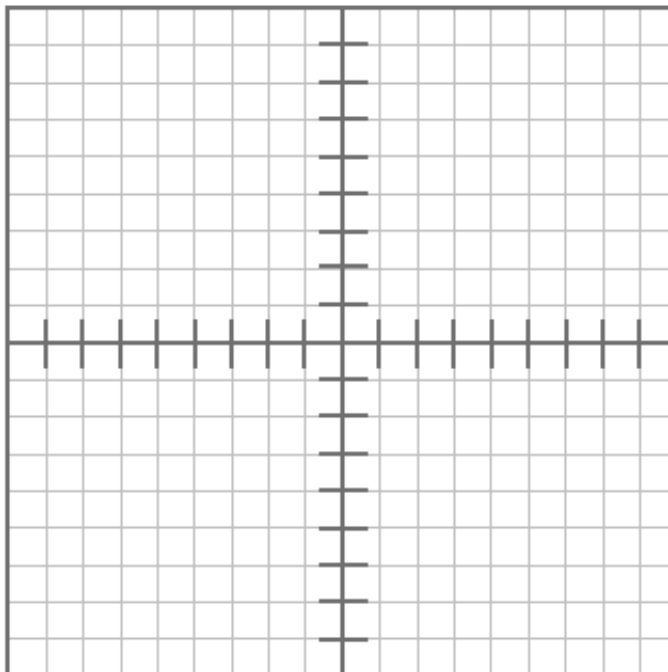
Name _____

In the event of a tie, the following questions will be graded in order. Please work them consecutively and show all your work.

Tie-Breaker #1

Using the given grid, draw a function that meets the following criteria:

- Exactly Four Integer Zeros
- Two Relative Minima
- One Relative Maximum
- Symmetry with respect to the y-axis
- A Range of $[-5, \infty)$



Name _____

Tie-Breaker #2

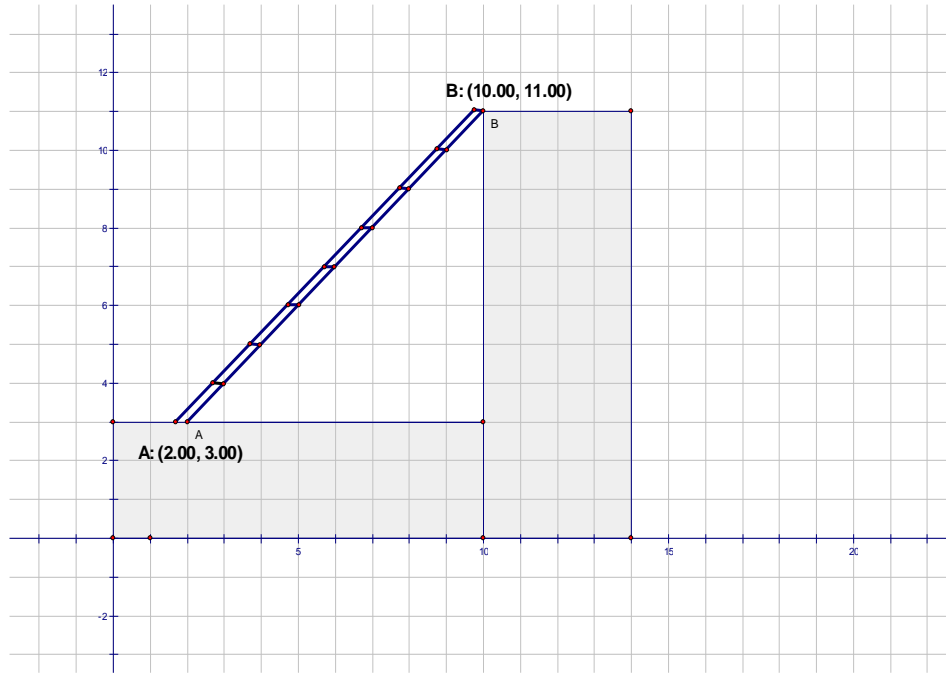
Determine and show how a commonly used binomial factoring technique can be used to calculate the following product:

$$1003 \times 997$$

Name _____

Tie-Breaker #3

A roofing company needs to get to the top of a house to fix the roof. Use the diagram below to answer the following questions. (Note that each box is 1ft X 1ft.)



- a) What is the length of the ladder in the diagram? (Round to two decimal places)

- b) What if you only had a 10 ft. ladder? What would the coordinates be for the base of the ladder if the height of the roof stayed the same?

- c) On the 10ft. ladder what would be the coordinates of the point that was exactly half way up the ladder?

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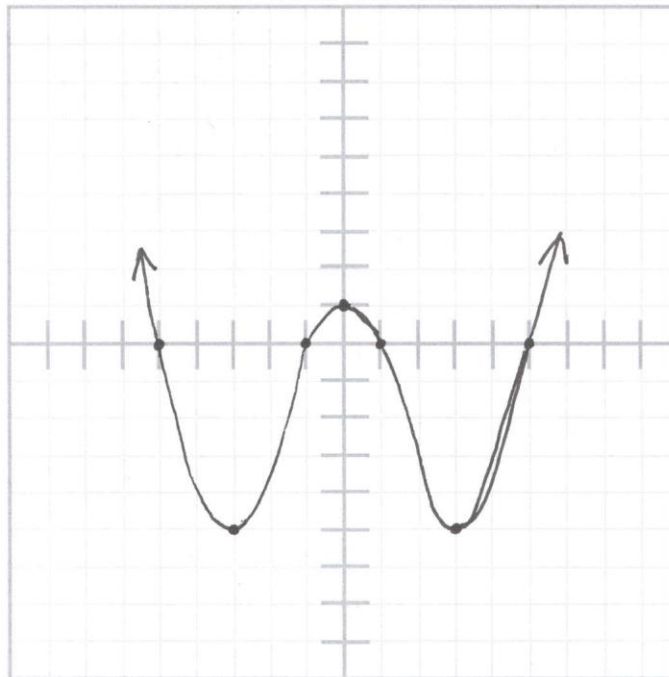
Answers:

1. D
2. C
3. D
4. B
5. D
6. C
7. A
8. D
9. B
10. B
11. B
12. C
13. A
14. B
15. B
16. C
17. D
18. A
19. A
20. C
21. A
22. B
23. A
24. D
25. D

Algebra I Tie Breakers ACTM
State Contest 2009

In the event of a tie, the following questions will be graded in order. Please work them consecutively and show all your work.

- Exactly Four Integer Zeros
- Two Relative Minima
- One Relative Maximum
- Symmetry with respect to the y-axis
- A Range of $[-5, 00)$



Tie-Breaker #2

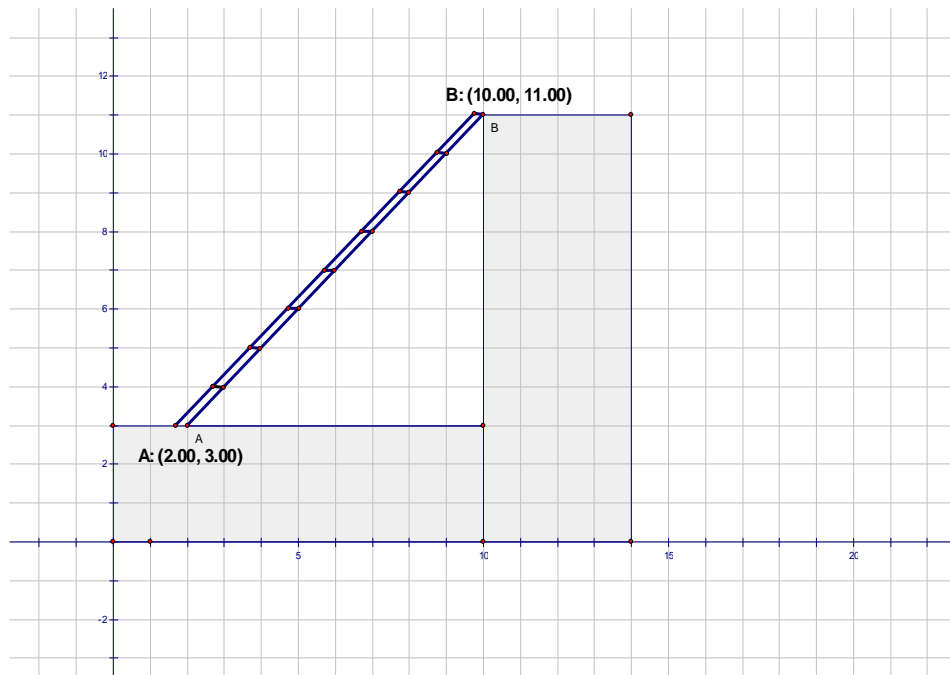
Determine and show how a commonly used binomial factoring technique can be used to calculate the following product:

$$1003 \times 997 =$$

$$\begin{aligned}(1000 + 3)(1000 - 3) &= \\ 1000^2 - 9 &= \\ 1000000 - 9 &= 999991\end{aligned}$$

Tie-Breaker #3

A roofing company needs to get to the top of a house to fix the roof. Use the diagram below to answer the following questions. (Note that each box is 1ft X 1ft.)



- a) What is the length of the ladder in the diagram? (Round to two decimal places)

$$d = \sqrt{(10 - 2)^2 + (11 - 3)^2} = 11.31$$

b) What if you only had a 10 ft. ladder? What would the coordinates be for the base of the ladder if the height of the roof stayed the same?

$$10 = \sqrt{(10 - x)^2 + (11 - 3)^2}$$

$$10^2 = \sqrt{(10 - x)^2 + 64}$$

$$100 = (10 - x)^2 + 64$$

$$\begin{array}{r} - 64 \\ 36 = (10 - x)^2 \end{array}$$

$$\sqrt{36} = \sqrt{(10 - x)^2}$$

$$6 = 10 - x$$

$$-4 = -x$$

$$x = 4$$

$$(4, 3)$$

c) On the 10ft. ladder what would be the coordinates of the point that was exactly half way up the ladder?

$$(4, 3) \quad (10, 11)$$

$$\left(\frac{14}{2}, \frac{14}{2}\right) = (7, 7)$$