

Arkansas Council of Teachers of Mathematics

State Algebra I Contest

April 24, 2010

For questions 1 through 25, mark your answer choice on the answer sheet provided. Make sure that any erasures are cleanly erased and that no stray marks are on the answer grid. After completing items 1 through 25, answer each of the tie-breaker items. Be sure that your name is printed on each of the tie-breaker pages.

1. Given the following sets of ordered pairs, which represents a function?
 - a. $\{(-1, 3), (-2, 6), (0, 0), (-2, -2)\}$
 - b. $\{(-2, -2), (0, 0), (1, 1), (2, 2)\}$
 - c. $\{(4, 0), (0, 0), (1, 1), (4, 3)\}$
 - d. $\{7, 4), (8, 8), (10, 8), (10, 10)\}$
 - e. None of the above

2. What is the x-intercept of the line defined by $-2x + 3y = 12$?
 - a. 6
 - b. 4
 - c. -4
 - d. -6
 - e. None of the above

3. Which of the following expressions is equivalent to $\left(\frac{x}{2} - 1\right)$?
 - a. $\frac{x-1}{2}$
 - b. $\frac{x-2}{2}$
 - c. $X - 1$
 - d. $X - 2$
 - e. None of the above

4. Which of the following expressions is NOT equivalent to the other three?
 - a. $\frac{\sqrt{3}a^2}{\sqrt{5}b}$
 - b. $\frac{5\sqrt{3}a^2}{3\sqrt{5}b}$
 - c. $\frac{\sqrt{15}a^2}{3b}$
 - d. $\frac{\sqrt{5}a^4}{\sqrt{3}b^2}$
 - e. All are equivalent

5. If $xy = 1$ and $x > 0$, which of the following statements is always true?
- As x increases, y decreases
 - As x increases, y increases
 - When x is greater than 1, y is negative
 - When x is less than 1, y is less than 1
6. Maria is having a birthday party for her friend, Miguel. A total of 50 people will be attending. She currently has eight sodas. Which inequality can be used to determine how many 12-packs of sodas (x) she should buy so that each person can have at least two sodas?
- $x + 8 \geq 50$
 - $12x + 8 \geq 50$
 - $x + 8 \geq 100$
 - $12x + 8 \geq 100$
 - None of the above
7. What is the equation of a line that is parallel to $-x + 2y = 8$ and has the same y -intercept as $3x + 2y = -6$?
- $y = -2x - 3$
 - $y + x = -6$
 - $2y = x - 6$
 - $y = 0.5x - 6$
 - None of the above

8. The diagram to the right shows a rectangular garden with a two-foot-wide sidewalk on three sides. The length of the garden is three times its width. If the garden's width in feet is " x " what is the area in square feet of the sidewalk, when the area of the garden is 75 square feet?
- 44 square feet
 - 58 square feet
 - 78 square feet
 - 96 square feet



9. Which of the following are not true under the laws of exponents?
- $(2^3)^{-2} = \sqrt{2^3}$
 - $(10^{-2})^4 = -10^8$
 - $(10^{-2})^4 = (1/100)^{-4}$
 - $(2^{-3})^{1/2} = 2^{2/3}$
 - All are not true

10. The equation of line l is $6x + 5y = 3$ and the equation of the line q is $5x - 6y = 0$. Which statement about the two lines is true?
- Lines l and q have the same y-intercept
 - Lines l and q are parallel
 - Lines l and q have the same x-intercept
 - Lines l and q are perpendicular
 - None of the above is true
11. Which function could be used to find the area of a rectangular picture frame that has a perimeter of 28 cm?
- $A(l) = (l - 4)(l - 7)$
 - $A(l) = (14 - l)(14 - l)$
 - $A(l) = 28l - l^2$
 - $A(l) = 14l - l^2$
12. Two vacuum cleaner salespeople receive a flat weekly fee plus a commission on each sale. Their weekly earnings are given by the following equations, where x represents the number of vacuum cleaners each person sells.
- Salesperson A's earnings = $12x + 150$
 Salesperson B's earnings = $12x + 300$
- Which of the following is true?
- Salesperson A earns twice as much as Salesperson B for each sale
 - Salesperson B earns twice as much as Salesperson A for each sale
 - Salesperson A's weekly earnings are one half the amount for Salesperson B
 - The salespeople earn the same flat weekly fee
 - Both salespeople earn the same commission on each sale.
13. Which of the following has the smallest value?
- 15.2%
 - $\frac{1}{8}$
 - 0.14
 - $\frac{7}{50}$
 - 13%
14. For her math class, Kat must express $(8m + 1)$ in several different ways. Which of the following is not equivalent to $(8m + 1)$?
- $\frac{(3+4)}{7} + m(10 - 8)^3$
 - $2 - 4(9m - 11m) - 1$
 - $\frac{16m}{2m} + \frac{4^2m}{2} - 7$
 - $6 + \frac{24m}{3} - 7$
 - $5 + 3 * 5m - (4 + 7m)$

15. Which is a factor of $x^3 + 26x^2 - 187x + 160$

- a. $(x - 5)$
- b. $(x + 1)$
- c. $(x - 32)$
- d. $(x + 16)$
- e. x

16. What is the solution set of the quadratic equation $8x^2 + 2x + 1 = 0$?

- a. $\left\{\frac{-1}{2}, \frac{1}{4}\right\}$
- b. $\{-1 + \sqrt{2}, -1 - \sqrt{2}\}$
- c. $\left\{\frac{-1 + \sqrt{7}}{8}, \frac{-1 - \sqrt{7}}{8}\right\}$
- d. No real solution

17. Sam purchased two bottles of water and three hot dogs at the ballpark for \$8.50. Mary purchased one bottle of water and two hot dogs for \$5.25. What system of equations could be solved to determine the prices in dollars of a hot dog (h) and a bottle of water (w)?

- a. $\begin{cases} 2w + 3h = 8.50 \\ w + 2h = 5.25 \end{cases}$
- b. $\begin{cases} 3w + 2h = 8.50 \\ w + 2h = 5.25 \end{cases}$
- c. $\begin{cases} w + h = 8.50 \\ w + h = 5.25 \end{cases}$
- d. $\begin{cases} 3w + 2h = 8.50 \\ 2w + h = 5.25 \end{cases}$
- e. None of the above

18. Expand and simplify this expression: $(2\sqrt[3]{a} + \sqrt{a})^2$.

- a. $4a^3 + a$
- b. $4\sqrt[3]{a^2} + 4\sqrt[6]{a^5} + a$
- c. $4a^{3/2} + 4a^{6/5} + a$
- d. $2\sqrt[6]{a} + a$
- e. None of the above

19. In an eighth-grade class of 30 students, the probability that a student chosen at random will be less than 13 years old is $\frac{1}{5}$. How many students in the class are less than 13 years old?

- a. Two
- b. Three
- c. Four
- d. Five
- e. Six

20. The factory listing on Clint's new car indicated the average mileage would be 30 miles per gallon (mpg). Clint's mileages for the past three 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
- e. Not enough information

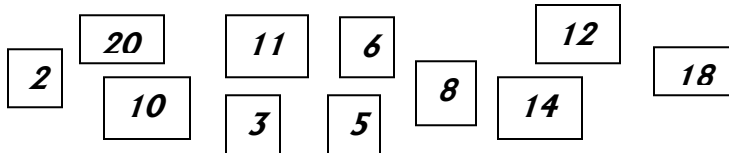
21. From a batch of 3,000 light bulbs, 100 were selected at random and tested. If 5 of the bulbs in the sample were found to be defective, about how many defective light bulbs would be expected in the entire batch?

- a. 15
- b. 60
- c. 150
- d. 300
- e. 600

22. Which fraction is equivalent to $\frac{\frac{3x}{5}}{\frac{x}{4} + \frac{x}{2}}$

- a. $\frac{x^2}{5}$
- b. $\frac{9x^2}{20}$
- c. $\frac{4}{5}$
- d. $\frac{9}{5}$

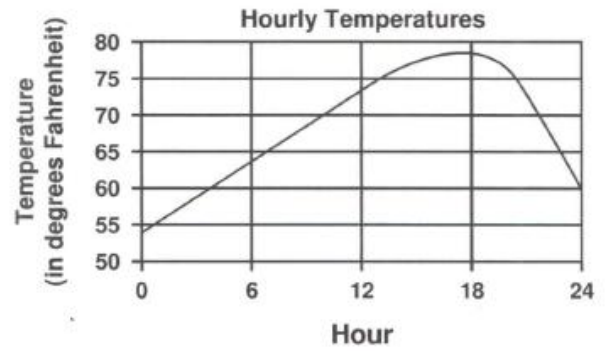
23. The eleven chips shown below are placed in a bag and mixed.



Chelsea draws one chip from the bag without looking. What is the probability that Chelsea draws a chip with a number that is a multiple of three?

- a. $\frac{1}{11}$
- b. $\frac{1}{3}$
- c. $\frac{4}{11}$
- d. $\frac{7}{11}$

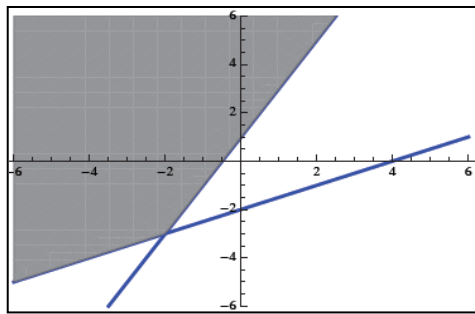
24. The graph shows the outside temperature recorded every hour for a 24-hour period in Larry's hometown. What is the range of this graph?
- 54°F to 78°F
 - 1 hour to 24 hours
 - 54°F to 60°F
 - 24 hours to 80 hours



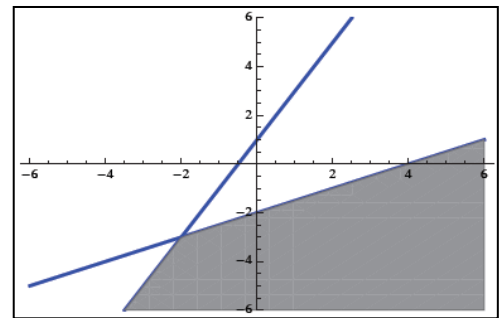
25. Which graph *best* represents the solution to this system of inequalities?

$$\begin{cases} y \geq 2x + 1 \\ y \leq 0.5x - 2 \end{cases}$$

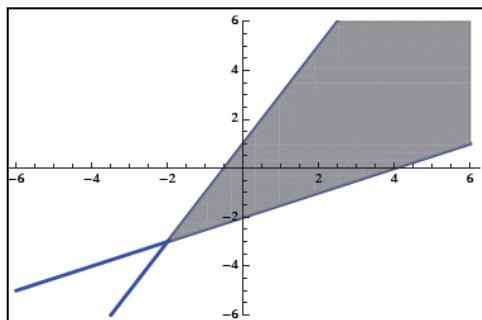
a.



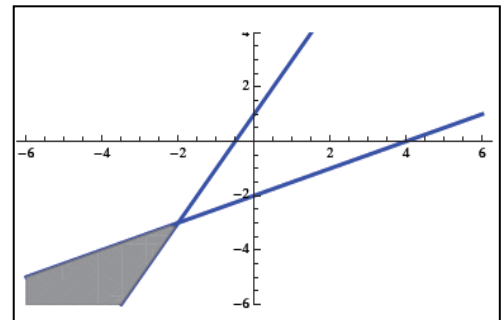
c.



b.



d.



Name: _____

Tie Breaker #1

Sally believes that the more time she spends in the grocery store, the more money she spends. Her recent purchases are recorded in the table below.

Minutes in store, x	Dollars spent, y
5	8
12	29
15	31
18	45
22	73
26	68

1. Determine the linear equation that represents the line of best fit for the given data.
2. Approximately how much money will Sally spend if she shops for 37 minutes?
3. If Sally has a monthly grocery budget of \$300 and shops twice a month, how long should Sally shop each visit?

Name: _____

Tie Breaker #2

Determine the value or values of x that solve the equation below. You should show your work and demonstrate that your response is correct.

$$(x^2 - 5x + 5)^{(x^2 - 9x + 20)} = 1$$

Answer Key

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

Tie Breaker 1:

1. Equation of line of best fit for data: $y = 3.2x - 10$
2. In 37 minutes Sally will spend approximately \$108.00
3. 46.9 or 47 minutes for each shopping trip.

Tie Breaker 2

The equation is satisfied if the exponent $(x^2 - 9x + 20) = 0$

$$(x^2 - 9x + 20) = (x - 5)(x - 4)$$

$$X = 5 \text{ or } x = 4$$

When $x = 5$ or $x = 4$, the exponent is zero, thus the equation = 1

Tie Breaker 3

1. $d = vt + 16t^2$
 $84 = 10t + 16t^2$
Solving for t
 $t = 2$
Time = 2 seconds
2. $d = vt + 16t^2$
 $d = 8(4) + 16(4)^2$
 $d = 288$ feet

Answer is not complete if units are not attached.