Arkansas Council of Teachers of Mathematics
2020 Algebra I Regional Exam

Work the multiple-choice questions first, choosing the single best response from the choices available. Indicate your answer here and on your answer sheet. Then attempt the tie-breaker questions at the end starting with tie breaker #1, then #2, and then #3. Turn in your answer sheet and the tie-breaker pages when you are finished. You may keep the pages with the multiple-choice questions. Figures are not necessarily drawn to scale.

1. In 1946, the lowest price of a World Series ticket was $1.20. By 2012, the lowest price of a ticket had increased to $110. Find the average rate of change in the lowest price of a World Series ticket from 1946 to 2012.

    A. Tickets increased an average of $66 each year.
    B. Tickets decreased an average of $108.80 each year.
    C. Tickets increased an average of $108.80 each year.
    D. Tickets decreased an average of $1.65 each year.
    E. Tickets increased an average of $1.65 each year.

2. Solve for x. $|2x - 3| - 5 = 4$

    A. $x = -3, 6$
    B. $x = 4, 6$
    C. $x = -0.5, 3.5$
    D. $x = 3.5, 4$
    E. No real solution

3. Which expression is equivalent to $\sqrt{20x^{12}}$?

    A. $2x^6\sqrt{5}$
    B. $2x^3\sqrt{5}$
    C. $2x^4\sqrt{5}$
    D. $4x^6\sqrt{5}$
    E. $4x^3\sqrt{5}$

4. Solve for x. $4x^2 - 38 = 158$?

    A. No real solution
    B. $x = 49$
    C. $x = -49, 49$
    D. $x = 7$
    E. $x = -7, 7$

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5. Write the equation of the line that passes through $(-3, -12)$ and $(3, -2)$ in slope-intercept form.

    A. $y = -\frac{7}{3}x + 5$
    B. $y = -\frac{7}{3}x - 9$
    C. $y = \frac{5}{3}x - 3$
    D. $y = \frac{5}{3}x - 7$
    E. None of the above

6. The Quadratic function graphed on the right represents the first of two equations in a system of equations, $y = x^2 - 5x - 6$.
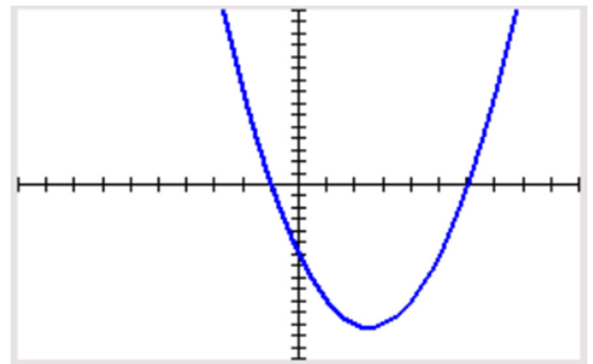
    If the graph of the second equation in the system is linear and passes through the points $(0, 4)$ and $(3, -2)$, which statement is true?

    A. The only solution to the system is $(-2, 8)$.
    B. The only solution to the system is $(5, -6)$.
    C. The solutions to the system are $(-2, 8)$ and $(5, -6)$
    D. The system has no solution.
    E. The system has an infinite number of solutions.

7. The zeros of a polynomial are -6 and 1. Find the polynomial with these zeros.

    A. $f(x) = x^2 + 5x - 6$
    B. $f(x) = 3x^2 + 15x - 18$
    C. $f(x) = -x^2 - 5x + 6$
    D. All of the above
    E. None of the above

8. If the graph of $y = 2^x - 1$ is shifted the right 5 units, which of the following equations describes the resulting graph?

    A. $y = 2^{x-5} - 1$
    B. $y = 2^{x+5} - 1$
    C. $y = 2^x - 6$
    D. $y = 2^x + 4$
    E. None of the above

9. Expand. $3(x - 2)^2 - 14x + 5$

    A. $3x^2 - 14x + 17$
    B. $3x^2 - 26x - 7$
    C. $3x^2 - 26x + 17$
    D. $9x^2 - 14x - 7$
    E. $9x^2 - 14x + 41$

10. A car rental company charges a flat fee of $45 plus $0.17 per mile the car is driven. Find an equation that can be used to determine the total cost, $C(x)$, if the rental car is driven for x-miles.

    A. $C(x) = 0.17x - 45$
    B. $C(x) = 0.17x + 45$
    C. $C(x) = 45x - 0.17$
    D. $C(x) = 45x + 0.17$
    E. $C(x) = 0.17x$

11. A ball is thrown from a height of 3 feet at an initial velocity of 5 ft/sec. The height of the ball $h(t)$, t seconds after the ball has been thrown is represented by $h(t) = -t^2 + 5t + 3$. This function is shown on the graph to the right.
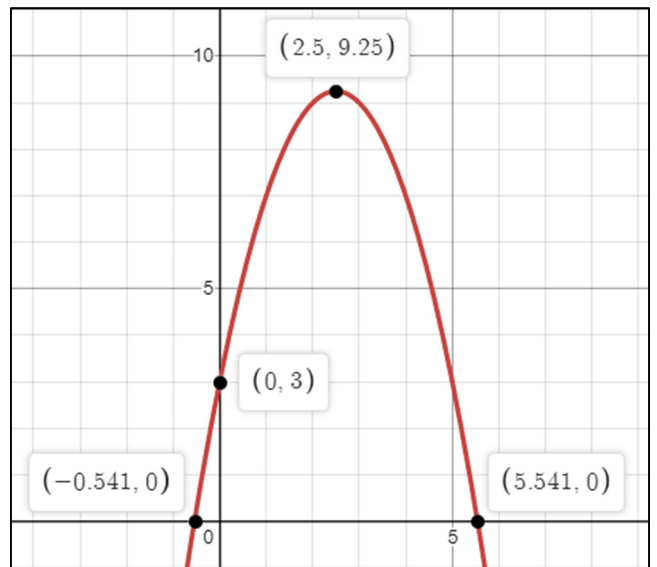
Determine the maximum height that the ball reaches.

    A. $-0.541\ feet$
    B. $3\ feet$
    C. $2.5\ feet$
    D. $9.25\ feet$
    E. $5.541\ feet$

12. Which values are solutions to $x^2 - 20x + 52 = 0$?

    A. $x = 10 \pm 8\sqrt{3}$
    B. $x = 20 \pm 4\sqrt{3}$
    C. $x = 10 \pm 4\sqrt{3}$
    D. $x = 20 \pm 8\sqrt{3}$
    E. No real solution

13. The perimeter of a rectangle is represented by $P = 2l + 2w$ (where $P = perimeter$, $l = length$, and $w = width$). A specific rectangle has a perimeter of 39 inches and a length of 11 inches. Determine the width of the rectangle.

   A. 8.5 inches
   B. 11 inches
   C. 17 inches
   D. 22 inches
   E. 28 inches

14. Combine: $\dfrac{3}{x+4} + \dfrac{2}{x-2}$

   A. $\dfrac{5}{x^2+2x-8}$
   B. $\dfrac{6}{x^2+2x-8}$
   C. $\dfrac{2x+7}{x^2+2x-8}$
   D. $\dfrac{3x-4}{x^2+2x-8}$
   E. $\dfrac{5x+2}{x^2+2x-8}$

15. Find the zero(s) of $f(x) = (x - 2)(x + 5)$.

   A. $(-5, 0)$ and $(2, 0)$
   B. $(0, -5)$ and $(0, 2)$
   C. $(0, -10)$
   D. $(-10, 0)$
   E. No real zeros

16. Which values are solutions to $x^2 + 11x - 60 = 0$?

   A. $x = -4, 15$
   B. $x = -15, 4$
   C. $x = -15, -4$
   D. $x = -6, 10$
   E. $x = -10, 6$

17. Which expression is equivalent to $\dfrac{7}{\sqrt{xy}}$?

    A. $\dfrac{7}{xy}$

    B. $\dfrac{\sqrt{xy}}{7}$

    C. $\dfrac{7x}{\sqrt{y}}$

    D. $\dfrac{7\sqrt{xy}}{xy}$

    E. $\dfrac{\sqrt{7}}{xy}$

18. Solve the following system of equations. $4x + 3y = 11$
    $$-5x + 2y = 15$$

    A. $(6, 5)$
    B. $(5, 6)$
    C. $(5, -1)$
    D. $(-1, 5)$
    E. No Solution

19. Katherine wants to build a rectangular puppy pen in her backyard. She has 16 meters of fencing and wants to use it all. The function $A(x) = -x^2 + 8x$ represents the area, $A(x)$, of the puppy pen as a function of the width, x. Which of the following statements best describes the domain of the function within the scenario?

    A. All real numbers
    B. $x \le 16$
    C. $x \ge 0$
    D. $0 < x < 16$
    E. $0 < x < 8$

20. Solve the following equation for x. $7(3x + 9) = 11 - (x + 3)$

    A. $x = \dfrac{5}{2}$

    B. $x = -\dfrac{5}{2}$

    C. $x = \dfrac{11}{4}$

    D. $x = -\dfrac{11}{4}$

    E. No Solution

21. Several terms of a sequence of numbers are $a_2 = 8$, $a_3 = 13$, $a_4 = 18$, $a_5 = 23$, and $a_6 = 28$. Based on this information, which equation can be used to find the term of the sequence a_n?

A. $a_n = 3n + 2$
B. $a_n = 3n + 4$
C. $a_n = 5n - 2$
D. $a_n = 5n + 2$
E. None of the above

22. The table below represents some points on the graph of an exponential function. What equation represents the same relationship?

x	0	1	2	3
y	2	1	0.5	0.25

A. $y = 2(0.5)^x$
B. $y = 2(1.5)^x$
C. $y = 0.5(2)^x$
D. $y = 2.5^x$
E. None of the above

23. Solve for x: $\sqrt{4x+1} - 2 = 1$

    A. $x = 0$
    B. $x = 2$
    C. $x = 3$
    D. $x = 8$
    E. No Solution

24. Given the equation below, solve for c.

$$4p - 3c = 5k$$

    A. $c = 5k - 4p$
    B. $c = 5k + 4p$
    C. $c = \frac{4p-5k}{3}$
    D. $c = \frac{5k+4p}{3}$
    E. None of the above

25. Which of the following relations shown below, if any, represent a function?

Relation A			Relation B			Relation C	
x	**y**		**x**	**y**		**x**	**y**
-3	5		-1	2		-5	2
0	0		2	2		-2	0
1	-1		5	-1		3	-1
1	2		6	-4		4	-3
3	1		8	1		7	-7

    A. Relation A only
    B. Relation C only
    C. Relations A and C
    D. Relations B and C
    E. None of the above

Tie Breaker #1

Name: _____

School: _____

A construction company is building a rectangular fence around a swimming pool. The length of the rectangular fence is 6 meters more than the width.

A. Let x represent the width of the fence. Write a simplified expression to represent the perimeter of the rectangular fence that will be built around the pool.

B. If the construction company plans to use exactly 124 meters of fencing, determine the dimensions on the fence.

Tie Breaker #2

Name: _____

School: _____

The admission fee for a museum is $5 for children and $12.50 for adults. On a given day, 284 people visited the museum and $3145 was collected from admission fees. How many children and how many adults visited the museum?

Tie Breaker #3

Name: _____

School: _____

The following table lists the numbers of commercial and savings banks in the United States for various years.

Year, x	Number of Banks, y
2010	8605
2011	8441
2012	8185
2013	7821
2014	7523
2015	7255
2016	6950
2017	6669

    A. Model the data with a linear function. Let the independent variable represent the number of years after 2010. If necessary, round coefficients to the nearest tenth.

    B. Using your function found in part A, predict the number of banks in the United States in 2020. If necessary, round to the nearest whole number.

    C. Using your function found in part A, predict the first year where the number of banks is fewer than 5000.

Answer Key:

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

Tie Breaker #1

    A. $P = 4x + 12$
    B. $L = 34m \quad W = 28m$

Tie Breaker #2

54 children, 230 adults

Tie Breaker #3

    A. $y = -286.9x + 8685.1$
    B. 5817 banks
    C. In year 2023 ($x = 13$), the number of banks is 4956.