For questions 1 through 25, mark your answer choice on the answer sheet provided. After completing items 1 through 25, answer each of the tiebreaker items in sequential order (do #1 first, followed by #2, and then #3 last). Be sure that your name is printed on each of the tiebreaker pages.

1. Solve the equation $\sqrt{x+1} - x = 0$. State your answer to 5 decimal places.

A) {-0.61803, 1.61803}   B {-0.61804, 1.61804}   C) {1.61803}   D) {1.61804}   E) None of these

2. If f(x) = $\frac{x}{x-1}$ and g(x) = $\frac{1}{2x}$, find the domain of (f o g)(x).

A) All real numbers   B) All real numbers except 1 and 0.   C) All real numbers except 0 and 1/2.

D) All real numbers except 0, 1, and 1/2.   E) None of these

3. Find the quotient: $\frac{3}{1-\sqrt{-2}\,i}$

A) $3 - \sqrt{2}i$ B) $-3 + \sqrt{2}$ C) $-3 + 3\sqrt{2}$ D) $3 - 3\sqrt{2}i$ E) None of these

4. Two perpendicular lines intersect in the point (1,2). If one of the lines has a slope of 5, find the equations for both lines.

A) $\begin{cases} x + 5y = 7 \\ 5x - y = 9 \end{cases}$ B $\begin{cases} 5x - y = 3 \\ x + 5y = 11 \end{cases}$ C $\begin{cases} 5x + y = 7 \\ 5x - y = 3 \end{cases}$ D) $\begin{cases} x + 5y = 11 \\ 5x - y = 4 \end{cases}$

E) None of these

5. Find $(f \circ g)(x)$ when $f(x) = 1 - 2x^2$ and $g(x) = 3x - 4$.

A) -18x^2 + 24x - 15   B) 36x^2 + 96x + 65   C) -6x^2 - 1   D) -6x^3 + 8x^2 + 3x − 4
E) None of these

6. Find a number k that makes the expression 4x^2 - 20xy − ky^2 a perfect square.

A) 9   B) 25   C) -25   D) 100   E) None of these

7. At precisely 10:59:57 AM a stone is thrown directly upwards from the ground with an initial velocity of 80 feet per second. The height of the stone is given by $s(t) = -16t^2+80t$. At what time will the stone hit the ground?

A) 10:59:02 AM   B) 11:04:57 AM   C) 11:04:02 AM   D) 11:00:02 AM
E) None of these

8. Simplify: $\left(\dfrac{-4x^3y^{-4}}{6x^{-2}z^2}\right)^{-3}$

A) $\dfrac{8x^{15}}{27y^{12}z^6}$ B) $\dfrac{-27y^{12}}{8x^9}$ C) $\dfrac{-27y^4z^2}{8x^5}$ D) $\dfrac{-27y^{12}z^6}{8x^{15}}$ E) None of these

9. Find a polynomial function of degree 4 that has integer coefficients with a zero of 2 with multiplicity 2 and a complex zero of 3i.

A) $x^4 - 4x^3 + 13x^2 - 36x + 36$ B) $x^4 - 4x^3 + 5x^2 - 4x + 4$ C) $x^4 - 4x^3 + 22x^2 - 72x + 72$
D) $x^4 - 8x^3 + x^2 + 9$ E) None of these

10. Find a point (x,y) in quadrant II that is on the line $2x + y = 1$ **and** on the parabola $y = 9 - x^2$.

A) (2,-3)   B) (-2,5)   C) (-2,7)   D) (-4,9)   E) None of these

11. Given two functions f and g where $f(x) = x$ and $g(x) = \sqrt{x}$, find the domain of the quotient f/g.

A) $(-\infty, \infty)$ B) $(-\infty, 0) \cup (0, \infty)$ C) $[0, \infty)$ D) $(0, \infty)$ E) None of these

12. Find one of the linear factors of $12x^2 + 41x - 15$.

A) (3x + 5)   B) (x + 15)   C) (4x - 1)   D) (3x - 1)   E) None of these

13. Assume C is any real number and y > 0, $\sqrt{27y^2C^2}=$?

A) $3\sqrt{3}yC$ B) $3\sqrt{3}y|C|$ C) $9\sqrt{3}|y|C$ D) $3\sqrt{3}|y|C$ E) None of these

14. Find a real number x whose cube root is half the sum of itself and 21.

A) -3   B) 27   C) -27   D) 8   D) None of these

15. Find the zeros of a quadratic function with discriminant 961 and axis of symmetry $x = \dfrac{25}{8}$.

A {-3/4, 7}   B) {3/4, -7}   C) {-1/4, 21}   D) {1/4, -21}   E) None of these

16. Suppose $f(x) = \begin{cases} x + 4 \ , x > 1 \\ x^2 \ , x \leq 1 \end{cases}$. Find x such that f(x) = 5.

A) $\{-\sqrt{5}, \sqrt{5}, 1\}$ B$\{-\sqrt{5}, \sqrt{5}\}$ C) $\{-\sqrt{5}, 1\}$ D$\{-\sqrt{5}\}$ E) None of these

17. Find the remainder when $2x^3 + 3x^2 + 4x + 10$ is divided by 2x + 3.

A) -4   B) 4   C) 10   D) $\dfrac{59}{4}$ E) None of these

18. Using transformations, describe how the graph of the equation $y = (3 - x)^2 + 1$ can be optioned from the graph of the basic function f(x) = x^2.

A) Shift left 3 units and up 1   B) Shift right 3 units and up 1
C) Shift left 3 units and down 1   D) Shift right 3 units and down 1
E) None of these

19. What is the coefficient of the x term in the polynomial expansion of $(2x + 1)^7$?

A) 7   B) 14   C) 28   D) 2   E) None of these

20. Find the linear factor for $125x^3 + 8$

A) 25x - 4   B) 25x + 4   C) 5x -2   D) 5x + 2   E) None of these

21. Find the vertical asymptote(s) for the graph of $y = \dfrac{2}{\ln{(x+1)}}$

A) x=-1   B) x=0, x=-1   C) x=0   D) x=2   E) None of these

22. Suppose A = $\begin{bmatrix} 1 & -2 \\ 1 & 4 \end{bmatrix}$, find A^{-1}.

A) $\begin{bmatrix} 1 & -\frac{1}{2} \\ 1 & \frac{1}{4} \end{bmatrix}$
B) $\begin{bmatrix} 1 & 0 \\ 0 & \frac{1}{4} \end{bmatrix}$
C) $\begin{bmatrix} \frac{1}{4} & \frac{1}{2} \\ \frac{1}{4} & -\frac{1}{4} \end{bmatrix}$
D) $\begin{bmatrix} \frac{2}{3} & \frac{1}{3} \\ -\frac{1}{6} & \frac{1}{6} \end{bmatrix}$
E) None of these

23. Suppose f(x) $= x^2 + 1$, where $x \leq 0$ find the inverse function f^{-1}(x).

A) f^{-1}(x) $= -\sqrt{x-1}$
B) f^{-1}(x) $= -\sqrt{x}-1$
C) f^{-1}(x) $= \sqrt{x}-1$
D) f^{-1}(x) $= \sqrt{x-1}$

E) None of these

24. Which statement best describes the the system of equations $\begin{array}{l} 8x+12y=36 \\ 10x+15y=35 \end{array}$.

A) The system is consistent and the equations are dependent.
B) The system is inconsistent and the equations are dependent.
C) The system is consistent and the equations are independent.
D) The system is inconsistent and the equations are independent.
E) None of these

25. Suppose that $75000 is invested in an account that pays $2\frac{1}{4}$% compounded continuously for 3 years. At the end of the 3 years, the total amount is rolled into another account paying 3% compounded semi-annually for 3 more years. Find the total amount after the 6 year period.

A) $87734.94   B) $87734.90   C) $87793.59   D) $87573.88   E) None of these

Name_____

Tie Breaker #1

Two cars are racing around a circular track at a constant speed. Assume Car A can complete the track 4 times in 36 minutes and Car B can complete the track 3 times in 24 minutes. If they start on the track at the same time and continue around as many times as needed, how much time will it take for them to finish at the same time?

Tie Breaker #2

Let $f(x) = x^2 + 1$, where $x \leq -2$. Find the inverse function $f^{-1}(x)$.

Tie Breaker #3

Solve the inequality $\sqrt{x + 3} \leq |2x + 3|$. Find an algebraic solution that does not require the use of a calculator.

Arkansas Council of Teachers of Mathematics
2014 State Exam
Algebra II

ANSWER KEY

1. C	Solution: Tie Breaker #1
2. C	Car A takes 9 minutes to complete the track one time.
3. C	Car B takes 8 minutes to complete the track one time.
4. B	LCM(8,9) = 72
5. E	
6. C	It will take 72 minutes for the cars to finish at the same time.
7. B	
8. D	
9. A	
10. B	
11. D	
12. D	
13. B	
14. C	Solution: Tie Breaker #2
15. A	$y = x^2+1$, x≤-2, y≥5
16. B	$x = y^2+1$, y≤-2, x≥5
17. B	Solve for y: $y=-\sqrt{x-1}$
18. A	
19. B	Therefore, $f^{-1}(x) =-\sqrt{x-1}$, where x≥5
20. D	Solution: Tie Breaker #3
21. C	$\sqrt{x+3} \le |2x+3|$
22. D	First solve the equation:$\sqrt{x+3} = |2x+3|$
23. A	Square both sides to get x+3=(2x+3)^2
24. D	This results in a quadratic equation: $4x^2+11x+6=0$
25. B	Factor (4x+3)(x+2)=0 to get zeros -2, -3/4
	The domain of $\sqrt{x+3}$ is x≥-3.
	Possible interval solutions are [-3,-2],[-2,-3/4], and [-3/4,∞).
	Check the intervals by substitution to determine that the only solutions are:
	[-3,-2] and [-3/4,∞).