Arkansas Council of Teachers of Mathematics
2013 Regional Exam
Algebra II

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) A toy company uses the linear model y = -3x + 571 to predict the decline in sales of a toy after it has been on the market more than one year. If x is the number of months after the first year and y is the number of toys sold in hundreds during that month, how many toys will be sold 13 months after the first year?

A) 61,000 B) -18,600 C) -170,000 D) 53,200 E) None of These

2) Your home state uses a linear model y= 22(x - 70) + 4338 to predict the number of vacationers (y) as compared to the average temperature for that week (x). Find the number of vacationers predicted for a week with an average temperature of 68 degrees.

A) 95,392 B) 7374 C) 4294 D) 5764 E) None of These

3) Find the quotient. Write the answer in standard form: $\frac{6+2i}{4-7i}$

A) $-\frac{2}{33}+\frac{10}{33}i$ B) $\frac{2}{13}+\frac{10}{13}i$ C) $\frac{38}{13}+\frac{34}{13}i$ D) $-\frac{38}{13}+\frac{34}{13}i$ E) None of These

4) Solve the equation $\sqrt{x+3}=x-3$

A) {1, 6} B) {6, 13} C) {1, 13} D) {6} E) None of These

5) Solve the equation $\left(x+7\right)^{\frac{3}{2}}=8$

A) {11} B) {- 5} C) {- 3} D) $\left\{\sqrt[3]{2},-7\right\}$ E) None of These

6) The temperatures in Cryostat storage in degrees Celsius roughly satisfy the inequality $|C + 95| \leq 53$. What range of temperatures corresponds to this inequality?

A) [- 148°C, 148°C] B) [- 42°C, 42°C] C) [- 148°C, - 42°C] D) [- 42°C, 148°C] E) None

7) Find the equation of the line passing through the points (5, 5) and (8, 4). Write your answer in slope-intercept form.

A) $y = -\frac{1}{3}x + \frac{20}{3}$ B) $y = x + \frac{20}{3}$ C) $y = \frac{1}{3}x + \frac{20}{3}$ D) $y = -\frac{1}{3}(x - 5)$ E) None

8) Find f(- 4) for $f(x) = \begin{cases} 2x, & \text{if } x \leq 1 \\ x - 2, & \text{if } x > 1 \end{cases}$

A) - 8 B) 2 C) - 6 D) 8 E) None of These

9) Describe how the graph of the equation $f(x) = -(x + 9)^2$ relates to the graph of $y = x^2$

A) a translation 9 units to the right and a reflection across the x-axis

B) a translation 9 units to the left and a reflection across the x-axis

C) a translation 9 units up and a reflection across the x-axis

D) a translation 9 units to the right and a reflection across the y-axis

E) None of These

10) For the given functions $f(x) = 7x + 14$ and $g(x) = 4x - 1$, find $(f \circ g)(x)$

A) 28x + 21 B) 28x + 7 C) 28x + 13 D) 28x + 55 E) None of These

11) If an object is propelled upward from a height of 144 feet at an initial velocity of 128 feet per second, then its height after t seconds is given by the equation $h(t) = -16t^2 + 128t + 144$. After how many seconds does the object hit the ground?

A) 9 B) 4.5 C) 8.0 D) 11 E) None of These

12) John owns a hotdog stand. He has found that his profit is represented by the equation $P(x) = -x^2 + 60x + 71$, with P being profits and x the number of hotdogs sold. How many hotdogs must he sell to earn the most profit?

A) 31 hotdogs B) 30 hotdogs C) 20 hotdogs D) 41 hotdogs E) None of These

13) Determine the remainder $(2x^3 - 5x^2 - 4x + 17) \div (x + 3)$

A) - 6 B) - 94 C) - 38 D) - 70 E) None of These

14) Find all rational zeros for $f(x) = x^3 + 6x^2 - 9x - 54$

A) 3, 6, - 3 B) - 4, - 6, 6 C) 4, 6, - 6 D) - 3, - 6, 3 E) None of These

15) Find the correct end behavior diagram for the given polynomial function $P(x) = 6x^3 + 3x^2 - 3x + 8$

A) Rises to the left, rises to the right

B) Falls to the left, falls to the right

C) Falls to the left, rises to the right

D) Rises to the left, falls to the right

16) Find an equation for the inverse of the function $f(x)=7x-4$

A) $f^{-1}(x)=\frac{x+4}{7}$ B) $f^{-1}(x)=\frac{x}{7}+4$ C) $f^{-1}(x)=\frac{x-4}{7}$ D) Not a one-to-one function

17) Suppose that $5000 is invested at an interest rate of 9% compounded continuously. What is the balance after 6 years.

A) $7700.00 B) $8580.03 C) $8385.50 D) $8680.03 E) None of These

18) Suppose $f(x)=30.7+1.4\log(x+1)$ models salinity of ocean water to depths of 1000 meters at a certain latitude. x is the depth in meters and f(x) is the salinity. Approximate the salinity (to the nearest hundredth) when the depth is 688 meters.

A) 85.73 B) -26.73 C) 34.67 D) 88.53 E) None of These

19) Find the value of $\log_7 24.10$ to four decimal places

A) 3.4429 B) 0.6115 C) 1.3820 D) 1.6353 E) None of These

20) Solve the equation $\log_6(x-3)=2$ for x

A) {61} B) {39} C) {33} D) {67} E) None of These

21) The growth in population of a city can be seen using the formula $p(t)=7858e^{0.002t}$, where t is the number of years since 1970. According to this formula, in how many years will the population reach 11,787? Round to the nearest tenth of a year.

A) 202.7 years B) 152.0 years C) 405.5 years D) 101.4 years E) None of These

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Find the indicated matrix.

22) Let $A=\begin{bmatrix} 1 & 3 \\ 2 & 5 \end{bmatrix}$ and $B=\begin{bmatrix} 0 & 4 \\ -1 & 6 \end{bmatrix}$. Find 4A + B.

A) $\begin{bmatrix} 4 & 7 \\ 7 & 11 \end{bmatrix}$ B) $\begin{bmatrix} 4 & 16 \\ 1 & 11 \end{bmatrix}$ C) $\begin{bmatrix} 4 & 16 \\ 7 & 26 \end{bmatrix}$ D) $\begin{bmatrix} 4 & 28 \\ 4 & 44 \end{bmatrix}$ E) None of These

23) Find the value of the determinant of $\begin{bmatrix} -5 & -2 \\ 8 & -3 \end{bmatrix}$.

A) -31 B) 31 C) -1 D) 34 E) None of These

24) Solve the system for x:
$$\begin{aligned} 2x+4y+z&=6 \\ 5x-3y-z&=-30 \\ 5x+y+5z&=-26 \end{aligned}$$

A) $\dfrac{\begin{vmatrix} 2 & 4 & 6 \\ 5 & -3 & -30 \\ 5 & 1 & -26 \end{vmatrix}}{\begin{vmatrix} 2 & 4 & 1 \\ 5 & -3 & -1 \\ 5 & 1 & 5 \end{vmatrix}}$ B) $\dfrac{\begin{vmatrix} 2 & 6 & 1 \\ 5 & -30 & -1 \\ 5 & 26 & 5 \end{vmatrix}}{\begin{vmatrix} 2 & 4 & 1 \\ 5 & -3 & -1 \\ 5 & 1 & 5 \end{vmatrix}}$ C) $\dfrac{\begin{vmatrix} 6 & 4 & 1 \\ -30 & -3 & -1 \\ -26 & 1 & 5 \end{vmatrix}}{\begin{vmatrix} 2 & 4 & 1 \\ 5 & -3 & -1 \\ 5 & 1 & 5 \end{vmatrix}}$ D) $\dfrac{\begin{vmatrix} 2 & 5 & 1 \\ 5 & -3 & -1 \\ 5 & 1 & 5 \end{vmatrix}}{\begin{vmatrix} 6 & 4 & 1 \\ -30 & -3 & -1 \\ -26 & 1 & 5 \end{vmatrix}}$

25) Solve the equation $x^2-10x+41=0$ for x.

A) {10 ± 8i} B) {- 5 ± 4i} C) {5 ± 4i} D) {9, 1} E) None of These

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Tie Breaker #1

The whispering gallery at the Museum of Science and Industry in Chicago has an elliptical cross section 13 feet 6 inches by 47 feet 4 inches. Write an equation to model this ellipse if it is centered at the origin and has foci on the x axis.

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Tie Breaker #2

Three cards are drawn from a standard deck of cards without replacement. Find the probability of drawing a diamond, a club and another diamond in that order.

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Tie Breaker #3

A kennel owner has 164 feet of fencing with which to enclose a rectangular region. He wants to subdivide this region into three smaller rectangles of equal length. If the total area to be enclosed is to be 576 ft^2, find the dimensions of the entire enclosed region.

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Algebra II Solutions:

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

Tie Breaker #1: $\frac{x^2}{\left(\frac{71}{3}\right)^2}+\frac{y^2}{\left(\frac{27}{4}\right)^2}=1$

Tie Breaker #2: $\frac{13}{850}=0.015$

Tie Breaker #3: 18 ft by 32 ft or 64 ft by 9 ft