2009 ACTM Regional Algebra II Exam
March 7, 2009

Circle the correct answer and mark it on the answer sheet.

1. Given x, y, and z are positive integers, which of the following is equivalent to $x^{\left(-\frac{y}{z}\right)}$?

   a. $-\sqrt[z]{x^y}$
   b. $\sqrt[y]{x^z}$
   c. $-\dfrac{1}{\sqrt[y]{x^z}}$
   d. $\dfrac{1}{\sqrt[z]{x^y}}$

2. Consider the table. Which function f(x) has all the characteristics?

Characteristic	f(x)
Domain	All real numbers
Range	Y<1
Intercept	(0,0)
Asymptote	Y = 1
As $x \rightarrow +\infty$	$y \rightarrow -\infty$
As $x \rightarrow -\infty$	$y \rightarrow 1$

   a. $f(x) = 2^x$
   b. $f(x) = -2^x$

   c. $f(x) = 2^x + 1$
   d. $f(x) = -2^x + 1$

3. Consider the functions: $f(x) = \dfrac{1}{\sqrt{x-4}}$ and g(x) = 2x. What is the domain of f(g(x)) over the set of real numbers?

   a. x > 0
   b. x > 2
   c. x > 4
   d. x ≥ 2

4. Find the remainder when $x^3 - 37x + 84$ is divided by x – 2.
   a. 14
   b. 18
   c. 150
   d. 162

5. Simplify: $\sqrt{x} \cdot \sqrt[3]{x^2y}$
   a. $\sqrt[6]{x^7 y^2}$
   b. $\sqrt[6]{x^3 y}$
   c. $x\sqrt[6]{xy^2}$
   d. can't be simplified

6. Rationalize the denominator of the following: $\dfrac{2}{\sqrt{a}+3}$

   a. $\dfrac{2\sqrt{a}-6}{a-9}$
   b. $\dfrac{2\sqrt{a}-6}{a+9}$
   c. $\dfrac{2\sqrt{a}+6}{a+9}$
   d. $\dfrac{2\sqrt{a}+6}{a-9}$

7. If xy is negative, which one of the following is possible?

   a. x < y < 0
   b. 0 < x < y
   c. x = y
   d. x < 0 < y

8. Let $g(x) = -x^2 + 4x + 1$ and find g(x + 2).
   a. $-x^2 + 4x + 3$
   b. $-x^2 + 4x + 5$
   c. $-x^2 + 5$
   d. $x^2 + 8x + 13$

9. What is the solution of the compound inequality: $\dfrac{x}{2}-4>0 \quad or \quad \dfrac{x}{2}+1<0$?

    a. all real numbers   b. no real numbers   c. $(-\infty,-2)\cup(8,\infty)$ d. (-2, 8)

10. Write $\dfrac{5}{3-2i}$ in standard form.

    a. $15-10i$ b. $\dfrac{15}{13}+\dfrac{10}{13}i$ c. $\dfrac{15}{13}-\dfrac{10}{13}i$ d. $3-2i$

11. Which translation takes $y=|x+2|-1 \quad to \quad y=|x|+2$?

    a. 2 right, 3 down   b. 2 right, 3 up   c. 2 left, 3 down   d. 2 left, 3 up

12. Which point maximizes N = 4x + 3y and lies within the feasible region of the constraints?

$$\begin{cases} y\le10 \\ x+y\le9 \\ x\le3 \end{cases}$$

    a. (0, 0)   b. (9, 0)   c. (0, 9)   d. (2, 5)

13. What is the maximum area in square units of a rectangle with a perimeter of 128 units?
    a. 1024   b. 4096   c. 256   d. 32

14. Which description of the graph of $y=ax^2+bx+c$ is not possible?
    a. There are two x-intercepts, the vertex is below the x axis and a > 0.
    b. There is one x intercept and the vertex is on the x axis.
    c. There are two x intercepts, the vertex is below the x axis and a < 0.
    d. There are no x intercepts, the vertex is above the x axis and a > 0.

15. Which statement is NOT true?
    a. $-5=-\sqrt{25}$ b. $-5=\sqrt[3]{-125}$ c. $-5=-\sqrt{-25}$ d. $5=-\sqrt[3]{-125}$

16. What is the inverse of $y=x^2-5$?

    a. $y=\pm\sqrt{x}+5$ b. $y=\pm\sqrt{x}-5$ c. $y=\pm\sqrt{x+5}$ d. $y=\pm\sqrt{x-5}$

17. An investment of $750 will be worth $1500 after 12 years of continuous compounding at a fixed interest rate. What is the interest rate?

    a. 2 %   b. 6.73%   c. 100%   d. 5.78%

18. What are the restrictions on x when $\dfrac{x^2-x-2}{x^2-9}$ is divided by $\dfrac{x-8}{x^2+10x+25}$?

    a. $x\neq\pm3$, -5   b. $x\neq\pm3$, or -8   c. $x\neq\pm3$, -5, or 8   d. $x\neq2, 9, 8,$ or -25

19. If x > 1, then which of the following has the least value?

   a. $\sqrt{x}$ b. $\sqrt{x \cdot x}$ c. $x\sqrt{x}$ d. $\sqrt{2x}$

20. If $|x| > |y|$, which of the following is the solution for x when y = -3?

   a. x > -3   b. x > 3   c. -3 < x < 3   d. x > 3 or x < -3

21. For real numbers x and y, when is the equation $|x + y| = |x - y|$ true?
   a. Only when x = y
   b. Only when x = 0 or y = 0
   c. Only when x = 0 and y = 0
   d. Never

22. The graph of the equation $y = 4^x$ is reflected over the y axis. What is the equation of the image?

   a. $y = -4^x$ b. $y = \left(\dfrac{1}{4}\right)^x$ c. $y = -4^{\ x}$ d. $y = -\left(\dfrac{1}{4}\right)^x$

23. Which of the following operations results in a valid calculation?

$$A = \begin{bmatrix} 1 & 3 \\ 4 & 2 \end{bmatrix} \qquad B = \begin{bmatrix} -1 \\ 3 \\ 4 \end{bmatrix} \qquad C = \begin{bmatrix} -1 & 4 & 5 \\ 1 & -3 & -8 \end{bmatrix}$$

   a. $A^2 + B^{-1}$ b. ABC c. $CB + A$ d. ACB

24. A function f is an even function if and only if f(x) = f(-x) for every value of x in the domain of f. One of the functions graphed below is an even function. Which one?

   a. y= sin x   b. y = x + 3   c. $y = x^2 + 3$ d. $y = x^3 - x$

25. Whitney's grandmother invested $150 at 5% interest compounded quarterly. When the account was recently given to Whitney, it contained $6230. How long ago did Whitney's grandmother invest the $150.

   a. ≈ 75 years ago   b. ≈ 8 years ago   c. ≈ 19 years ago   d. ≈ 42 years ago
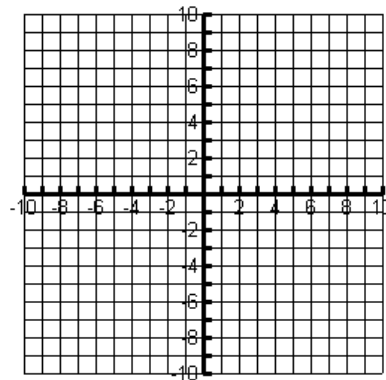
Name _____

Tie Breaker #1

An open box is to be made from a square piece of material 36 cm. on a side by cutting equal squares from the corners and turning up the sides. Find the size square you should remove for the box to have a maximum volume and find the maximum volume? Show your work and method of solution.

Tie Breaker #2

Graph the following: $g(x) = \begin{cases} x+4, x < -1 \\ x^2, x \geq -1 \end{cases}$

Tie Breaker #3

Solve the following. Show all work and state your solution.

Amy, Jason and Courtney went to get food for their friends at school. Amy spent $6.35 on two burgers, one order of french fries, and two colas. Jason ordered 1 burger, 2 orders of french fries, and two colas. His bill was $5.45. Courtney's order of 3 burgers, 3 orders of french fries, and 3 colas totaled $11.01. Find the price of each item.

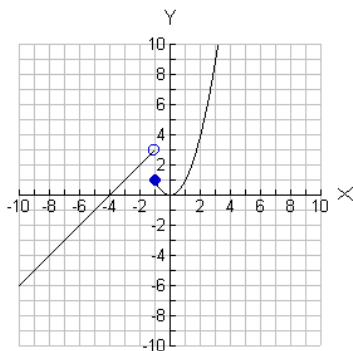## 2009 ACTM Regional Algebra II Exam ANSWERS
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1. D
2. D
3. B
4. B
5. C
6. A
7. D
8. C
9. C
10. B
11. B
12. C
13. A
14. C
15. C
16. C
17. D
18. C
19. A
20. D
21. B
22. B
23. D
24. C
25. A

Tiebreakers:

#1. 6 cm. square and a volume of 3456 cu. cm.

#2.

#3. Burger, $1.89; fries, $.99; cola, $.79