

## 2010 ACTM Regional Algebra Exam

In each of the following choose the best answer and bubble the corresponding letter on the answer sheet provided. Be sure to work all 25 questions before attempting the tie-breaker problems. Be aware that the figures are not always drawn to scale.

1. A student solved a quadratic equation and got the following:

$$x = \frac{-3 \pm \sqrt{4^2 - 4(2)(5)}}{2(1)}$$

What conclusion can that student make about the graph of the equation?

- It crosses the axis in two places
  - It does not cross the x-axis
  - It sits on the x-axis
  - This student made an error in using the Quadratic Formula.
2. Which is not a factor of  $x^3 - 3x^2$ ?
- $(x - 3)$
  - $x$
  - $x^2$
  - $(x - 3)^2$
3. If the minimum point of  $F(x) = |x|$  is at the origin, what is the minimum point of  $G(x) = |x - 3| + 4$ ?
- (3, 4)
  - (-3, -4)
  - (3, -4)
  - (-3, 4)
4. Ron wants to build a rectangular patio that is 648 square feet. He wants the patio's length to be twice its width. What will be the dimensions of the deck, rounded to the nearest foot?
- 27ft x 24ft
  - 18ft x 36ft
  - 20ft x 40ft
  - 15ft x 30ft

5. The formula for the surface area of a regular pyramid is  $S = \frac{1}{2}BA + \frac{3}{2}BD$ . Which equation solves A in terms of S, D, and B?

a.  $A = \frac{2S-3BD}{4B}$

b.  $A = \frac{S-3BD}{2B}$

c.  $A = \frac{S-3B}{2BD}$

d.  $A = \frac{2S-3BD}{B}$

6. Solve for x.  $-4 \leq \frac{1}{6}(x + 18) \leq 10$ .

a.  $-42 \leq x \leq 42$

b.  $-132 \leq x \leq -48$

c.  $-6 \leq x \leq 78$

d.  $x = -18$

7. Solve the following system of equations:

$$\begin{cases} 2y + 3x = 210 \\ 3y - 2x = 42 \end{cases}$$

a.  $x=42, y=42$

b.  $x=0, y=105$

c.  $x=20, y=9$

d.  $x=15, y=80$

8. You are shopping for a new car and find two great deals. One new Camry costs \$26,500 to purchase and costs approximately \$0.12 per mile to maintain, while a new Accord costs \$24,000 to buy and is an average of \$0.17 per mile to maintain. Determine how many miles must be driven for the total costs of the two models to be the same.

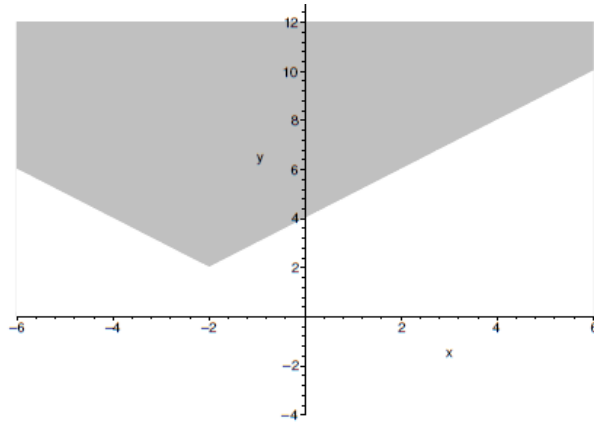
a. 168,333.33 miles

b. 5,000 miles

c. 50,000 miles

d. 75,283.3 miles

9. Which inequality represents the shaded region of the graph below?



- a.  $y \leq |x - 2| + 2$
- b.  $y \geq |x + 2| + 2$
- c.  $y \geq |x - 2| + 2$
- d.  $y \leq |x + 2| + 2$

10. S is inversely proportional to T. If  $S=18$  when  $T=2$ , find S when  $T=6$ .

- a.  $S = 54$
- b.  $S = 6$
- c.  $S = \frac{2}{3}$
- d.  $S = \frac{1}{9}$

11. Tony called 7 pizza companies to find the best price for a large one-topping pizza. The prices were \$7.15, \$7.25, \$6.35, \$6.75, \$7.65, \$7.75, and \$8.00. He determined that the median price was \$7.25. If Tony received an additional quote of \$8.00, what affect will this have on the median?

- a. The median will decrease by \$0.75
- b. The median will remain the same.
- c. The median will increase by \$0.20.
- d. The median will increase to \$8.00.

12. Erin's bank summarizes the change in their checking and savings accounts throughout the day. Using the internet, she views the following reports for two days.

<u>Day 1</u>			<u>Day 2</u>		
	Savings	Checking		Savings	Checking
<i>AM</i>	30	-10	<i>AM</i>	20	-70
<i>Noon</i>	110	0	<i>Noon</i>	200	40
<i>PM</i>	-20	80	<i>PM</i>	50	30

What is the net change, or difference, in her account balance?

a. Change over 2 days

	Savings	Checking
<i>AM</i>	-10	-80
<i>Noon</i>	90	-40
<i>PM</i>	-20	80

c. Change over 2 days

	Savings	Checking
<i>AM</i>	-10	-60
<i>Noon</i>	90	40
<i>PM</i>	70	-50

b. Change over 2 days

	Savings	Checking
<i>AM</i>	-10	60
<i>Noon</i>	-90	-40
<i>PM</i>	-70	50

d. Change over 2 days

	Savings	Checking
<i>AM</i>	50	-80
<i>Noon</i>	310	40
<i>PM</i>	30	110

13. A bag of marbles contains 6 red, 6 white, and 3 blue marbles. The first marble that is drawn out of the bag is white. Without replacing it, a second marble is drawn and it is blue. Neither marble is replaced. What is the probability that the third marble drawn will be red?

a.  $\frac{4}{25}$

c.  $\frac{6}{15}$

b.  $\frac{1}{6}$

d.  $\frac{6}{13}$

14. Which recursive formula shows how to determine the next 3 terms in the sequence below?

3, 6, 9, 12, 15, \_\_, \_\_, \_\_

a.  $a_1 = 3; a_n = 2(a_{n-1})$

b.  $a_1 = 6; a_n = a_{n-1} - 3$

c.  $a_1 = 3; a_n = a_{n-1} + 3$

d.  $a_1 = 6; a_n = \frac{a_{n-1}}{2}$

15. Reduce this expression into its SIMPLEST form.

$$\frac{\sqrt{4 \cdot \left(\frac{3}{8} + \frac{5}{8}\right) + (3^3 - 2^3)}}{\sqrt{(25-16)}}$$

- a. 3
- b. 7
- c. 21
- d. 5

16. What is the domain of the function  $F(x) = \frac{(x+1)}{(x-1)}$ ?

- a. All real numbers
- b. All real numbers except  $x = -1$
- c. All real numbers except  $x = 1$
- d. All real numbers except  $x = 0$

17. Simplify  $\frac{-12\sqrt{30}}{3\sqrt{6}}$

- a.  $-4\sqrt{30}$
- b.  $4\sqrt{5}$
- c.  $-4\sqrt{5}$
- d.  $-4\sqrt{6}$

18. Reduce this expression to its SIMPLEST form.

$$\sqrt[3]{\frac{x^6}{x^{-3}}}$$

- a.  $x$
- b.  $3x$
- c.  $x^3$
- d.  $x^{\frac{2}{3}}$

19. According to Ohm's Law, voltage ( $V$ ) is measured by  $V = IR$  with  $I$  and  $R$  representing current and resistance respectively. Correspondingly, power ( $P$ ) is measured by  $P = IV$ .

Using the two formulas, which expression represents the power formula in terms of voltage and resistance?

- a.  $VR^2$
- b.  $RV^2$
- c.  $IV$
- d.  $\frac{V^2}{R}$

20. A line passes through the points (1, -7) and (-1, 3). Which of the following equations would represent this line?

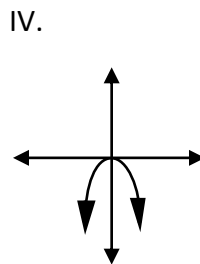
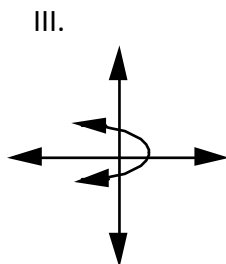
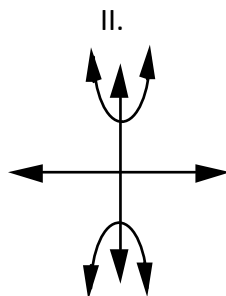
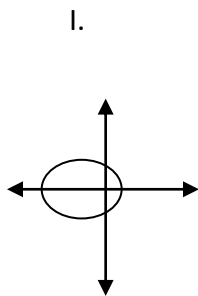
- a.  $x + y = -2$
- b.  $5x + y = -2$
- c.  $5x + y = -3$
- d.  $5x - y = 2$

21. Brianna is a small business owner making t-shirts. Based on her yearly data, she has calculated her monthly cost,  $y$ , of producing  $x$  t-shirts using the function

$y = 2.8x + 421$ . What does the  $y$ -intercept represent?

- a. The cost of producing one t-shirt
- b. The base monthly cost of running her business
- c. The revenue made on sales of t-shirts
- d. The price she charges for each t-shirt

22. Determine which of the following graphs represent  $y$  as a function of  $x$ .



- a. I & IV
- b. II & IV
- c. I & III
- d. IV only

23. A local Church is having a walk-a-thon to raise money to help Haiti. Each participant will have a sponsor that pledges \$25.00 and an additional \$.10 for every mile the participant walks. The equation  $d = .10m + 25$  will determine the total donation  $d$  assessed to each sponsor based on the number of miles  $m$  the participant walks. What does the independent variable represent in the equation?

- a. The amount the sponsor will pay.
- b. The number of miles walked.
- c. The \$25 the sponsor will pay.
- d. How fast the participant will walk.

24. The circumference of a circle can be written as  $C(r) = 2\pi r$ , where  $r$  is the radius of a circle. What is the range of the function (in terms of  $\pi$ ) when the domain is  $\{1, 2, 3, 4\}$ ?

- a.  $\{2, 4, 6, 8\}$
- b.  $\{2\pi, 4\pi, 6\pi, 8\pi\}$
- c.  $\{6.28, 12.56, 18.84, 25.12\}$
- d.  $\{2\pi, 8\pi, 18\pi, 32\pi\}$

25. Which of the following equations represents a line that would be perpendicular to a line that passes through  $(-2, 1)$  and  $(2, 3)$ ?

- a.  $y = 2x - 3$
- b.  $y = \frac{1}{2}x + 2$
- c.  $y = \frac{-1}{2}x - \frac{3}{2}$
- d.  $y = -2x + 5$

Name: \_\_\_\_\_ School: \_\_\_\_\_

Tie Breaker #1

- a. An ant has a mass of approximately  $4.0 \times 10^{-3}$  grams. An ant can carry up to 25 times its body weight. Determine the maximum mass (in grams) that an ant can carry. Express your answer in scientific notation.

- b. A sandwich at a picnic is made of the ingredients below:

<b>Ingredient</b>	<b>Mass</b>
2 slices of bread	25 grams each
Peanut butter	30 grams
Jelly	18 grams

Determine the total mass of the sandwich (in grams). Determine how many ants it would take to carry the sandwich if each ant carried the maximum amount possible. Express your answer in scientific notation.



Name: \_\_\_\_\_ School: \_\_\_\_\_

Tie Breaker #2

Given that the points  $(-5, 0)$  and  $(-3, -4)$  are two vertices of a triangle, find a point that forms a right triangle. Demonstrate that the triangle is a right triangle.

Tie Breaker #3

A rectangle and a square have the same area. The length of the rectangle is forty-eight inches more than two times its width. The length of a side of the square is forty-eight inches. The side of the square is seventy-two inches less than five times the width of the rectangle. What are the dimensions of the rectangle?

## Answer Key

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

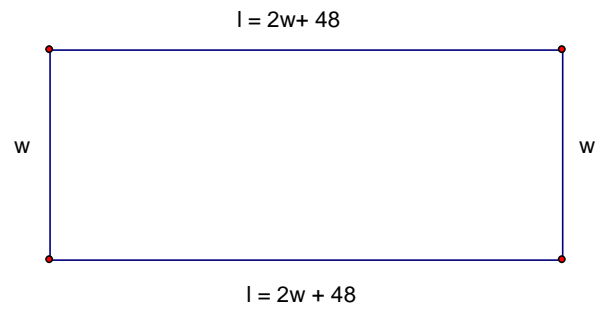
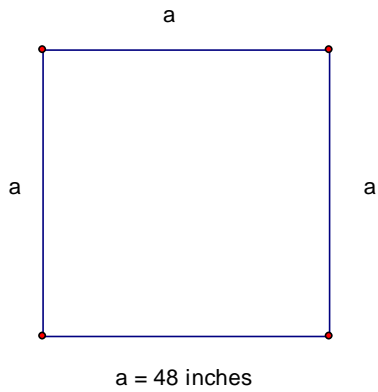
### Tie Breaker #1

- A. 0.1 grams or  $1 \times 10^{-1}$
- B. 980 ants or  $9.8 \times 10^2$

### Tie Breaker #2

Two sides of the triangle must have slopes that are negative reciprocals.  
Or, using the three points, show that the Pythagorean Theorem holds.

### Tie Breaker #3



$$\text{Area of rectangle} = \text{Area of square} = 48 \times 48 = 2304 \text{ in}^2 = (w)(2w + 48)$$

$$2w^2 + 48w - 2304 = 0$$

Graph and find zeros:  $w = 24, -48$

Rule out  $-48$ .

If  $w = 24$  in., then  $l = 2(24) + 48 = 96$  in.