

ACTM Regional Algebra II Exam  
March 6, 2010

Place the letter of the correct answer in the space provided as well as on the answer sheet. Make sure you attempt the tie-breaker questions at the end of the test if you have time.

\_\_\_\_\_ 1. If the area of a square is  $x^2 - 10x + 25$  meters, what is the length in meters of one side of the square?

- a.)  $x - 10$     b.)  $x - 5$     c.)  $x + 5$     d.)  $x^2 - 10$

\_\_\_\_\_ 2. Find the value of  $c$  that makes  $4x^2 + 12x + c$  a perfect square trinomial.

- a.) 36    b.) 4    c.) 1    d.) 9

\_\_\_\_\_ 3. If a population grows at a rate of 3% per year, about how long will it take the population to double?

- a.) 23.4 years    b.) 59.2 years    c.) 68.0 years    d.) 74.9 years

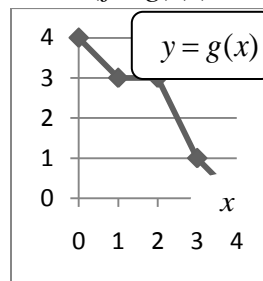
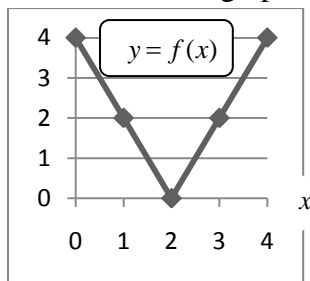
\_\_\_\_\_ 4. What value of  $b$  will make the determinant of  $\begin{bmatrix} 3 & b \\ -2 & 5 \end{bmatrix}$  equal to 1?

- a.) -7    b.) 7    c.) -1    d.)  $\frac{7}{5}$

\_\_\_\_\_ 5. Find the value of  $c$  that will give the solution set:  $\left[-2, \frac{-4}{3}\right]$  for the inequality  $|3x + c| \leq 1$ .

- a.) -2    b.) 5    c.) -5    d.) 2

\_\_\_\_\_ 6. Use the graphs of  $f$  and  $g$  below to evaluate  $(f \circ g)(3)$ .



- a.) 3    b.) 1    c.) 4    d.) 2

- \_\_\_\_\_ 7. Solve the following equation for  $x$ :  $\log_2(x) + \log_2(x-3) = 2$
- a.)  $x = 1$       b.)  $x = 4$  or  $x = -1$       c.)  $x = 4$       d.)  $x = 3$  or  $x = 4$
- \_\_\_\_\_ 8. If  $\log_b 2 = 0.44$  and  $\log_b 3 = 0.68$ , what is the value of  $\log_b \left( \frac{2\sqrt{2}}{3} \right)$ ?
- a.) 0.42      b.) -0.02      c.) -0.22      d.) -0.06
- \_\_\_\_\_ 9. Find the solution set of the equation:  $x^2 - 5bx - 10cx + 50bc = 0$ , where  $b$  and  $c$  are constants.
- a.)  $-50bc, 5b + 10c - 50bc$       b.)  $-5b, -10c$       c.)  $5b, 10c$       d.)  $0, 50bc$
- \_\_\_\_\_ 10. A snack mix contains exactly 43 raisins, 26 peanuts, 14 walnuts, and 17 slices of dried banana. If Ruth randomly selects one item from the snack mix, what is the probability that she will not pick a nut?
- a.)  $3/5$       b.)  $2/5$       c.)  $2/3$       d.)  $43/100$
- \_\_\_\_\_ 11. At a fabric store, silk costs three times as much as cotton. A customer buys 4 yards of cotton and 1.5 yards of silk for a total cost of \$55. What is the cost per yard of cotton?
- a.) \$19.41      b.) \$33.00      c.) \$6.47      d.) \$5.23
- \_\_\_\_\_ 12. There are three different kinds of socks in a bag: red, blue, and yellow. The probability of choosing a red sock is  $1/5$ . If there are twice as many blue socks as red socks, what is the probability of choosing a yellow sock?
- a.)  $4/5$       b.)  $1/5$       c.)  $3/5$       d.)  $2/5$
- \_\_\_\_\_ 13. Assume that  $(a, b)$  is a point on the graph of  $y = f(x)$ . What is the corresponding point on the graph of  $y = f(x-3)$ ?
- a.)  $(a, b-3)$       b.)  $(a-3, b)$       c.)  $(a+3, b)$       d.)  $(a, b+3)$

\_\_\_\_\_ 14. Simplify:  $\sqrt{(x-1)^2 + 1}$

- a.)  $x$       b.)  $\sqrt{x^2 - 2x + 2}$       c.)  $\sqrt{x}$       d.)  $\sqrt{x^2 + 2}$

\_\_\_\_\_ 15.  $\ln\left(\frac{2}{\ln\sqrt{e}}\right) =$

- a.) 0      b.)  $\ln 4$       c.) 1      d.)  $\ln 2$

\_\_\_\_\_ 16. Solve for  $A$  and  $B$ :  $\frac{16}{(x+5)(x-3)} = \frac{A}{x+5} - \frac{B}{x-3}$

- a.)  $A = -2$  and  $B = 2$       b.)  $A = 2$  and  $B = -2$   
c.)  $A = -2$  and  $B = -2$       d.)  $A = 2$  and  $B = 2$

\_\_\_\_\_ 17. Two lines typically intersect in one point. Find the equation of the line that has slope  $m = -2$  and passes through the intersection point of  $2y - 4x = 6$  and  $y - 3x = 1$ .

- a.)  $y = -2x + 11$       b.)  $y = 2x - 3$       c.)  $y = -2x - 3$       d.)  $y = -2x + 4$

\_\_\_\_\_ 18. Let  $f(x) = \frac{1}{x\sqrt{4-x^2}}$ . The domain of the function  $f$  is

- a.)  $(-\infty, -2) \cup (2, \infty)$       b.)  $(-2, 2)$       c.)  $(-2, 0) \cup (0, 2)$       d.)  $(-\infty, \infty)$

\_\_\_\_\_ 19.. Which of the following is a root of  $P(x) = 2x^4 + 7x^2 - 15$ ?

- a.)  $x = -5$       b.)  $x = \frac{\sqrt{3}}{2}$       c.)  $x = -\sqrt{3}$       d.)  $x = -\frac{\sqrt{6}}{2}$

\_\_\_\_\_ 20. The coefficient in front of the  $x^4$  term in  $(x-1)^6$  is

- a.) -24      b.) 1      c.) 15      d.) 24

\_\_\_\_\_ 21. Roger's lawn is  $10,500 \text{ ft}^2$ . Roger mows the lawn at a rate of  $200 \text{ ft}^2 / \text{min}$  and his friend Ray mows the lawn at a rate of  $300 \text{ ft}^2 / \text{min}$ . How long will it take them to mow Roger's lawn if they use both of their mowers at the same time?

- a.) 21 minutes      b.) 102.5 minutes      c.) 30 minutes      d.) 66 minutes

\_\_\_\_\_ 22. If  $f(x) = \frac{1}{2x}$ , then  $\frac{f(x+h) - f(x)}{h}$  can be simplified to

- a.)  $\frac{1}{2(x+h)}$       b.) 1      c.)  $\frac{1}{2x}$       d.)  $-\frac{1}{2x(x+h)}$

\_\_\_\_\_ 23. Perform the indicated operations and reduce to lowest terms:  $\frac{3+i}{1+2i}$

- a.)  $1+i$       b.)  $2-i$       c.)  $1-i$       d.) 5

\_\_\_\_\_ 24. Find the inverse of  $f(x) = e^{2x}$ .

- a.)  $f^{-1}(x) = e^{\frac{x}{2}}$       b.)  $f^{-1}(x) = \ln \sqrt{x}$       c.)  $f^{-1}(x) = \ln(2x)$       d.)  $f^{-1}(x) = e^{-2x}$

## TIEBREAKERS

Name \_\_\_\_\_

Show all your work to receive maximum credit.

1. The length of the shadow of a large tree is 15 feet. The length of the shadow of a 5 foot tall tree next to the larger tree is 6 inches. How tall is the large tree?

Name \_\_\_\_\_

2. A new strain of flu spreads through a town according to the model

$$N = \frac{40,000}{1 + 39,999e^{-0.7t}}$$

where  $N$  is the number of townspeople with the flu  $t$  days after the first case. The mayor will proclaim the flu an epidemic when 25% of the town has the flu. After how many days will the flu officially be an epidemic?

Name \_\_\_\_\_

3. You are contemplating two job offers in sales. One job pays no salary but a commission of 10% of what you sell. The second job pays a salary of \$500 per week plus a commission of 4%. What is the minimum amount of sales per week you must make in order to make the straight commission job the better offer?

## ANSWERS

1. b
2. d
3. a
4. a
5. b
6. d
7. c
8. b
9. c
10. a
11. c
12. d
13. c
14. b
15. b
16. c
17. a
18. c
19. d
20. c
21. a
22. d
23. c
24. b

Tiebreaker 1

150 ft.

Tiebreaker 2

13.5 days, or about 14 days.

Tiebreaker 3

\$8333.33