

FIFTY-FIRST ANNUAL MATHEMATICS CONTEST  
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THE TENNESSEE MATHEMATICS TEACHERS' ASSOCIATION

**Algebra I 2007**

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Scoring formula:  $4R - W + 40$

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**DIRECTIONS:**

Do not open this booklet until you are told to do so.

This is a test of your competence in high school mathematics. For each problem, determine the best answer and indicate your choice by making a heavy black mark in the proper place on the separate answer sheet provided. You must use a pencil with a soft head (No. 2 lead or softer).

This test has been constructed so that most of you are not expected to answer all of the questions. Do your best on the questions you feel you know how to work. You will be penalized for incorrect answers, so wild guesses are not advisable.

If you change your mind about an answer, be sure to erase completely. Do not mark more than one answer for any problem. Make no stray marks of any kind on the answer sheet. The answer sheets will not be returned to you. If you wish a record of your performance, mark your answers in this booklet also. You will keep the booklet after the test is completed.

When told to do so, open your test booklet and begin. You will have exactly 80 minutes to work.

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Contributors to TMTA for the Annual Mathematics Contest:

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Algebra I 2007

1. Solve the equation for x:  $x(2x-9) - 5 = 0$ 
  - a)  $\{\frac{1}{2}, 5\}$
  - b)  $\{-\frac{1}{2}, 5\}$
  - c)  $\{\frac{9}{2}, -5\}$
  - d)  $\{5, \frac{9}{2}\}$
  - e)  $\{-\frac{5}{2}, 1\}$
  
2. Determine the slope and y-intercept of the line:  $2x + 5y - 25 = 0$ 
  - a)  $-\frac{2}{5}; (0, -5)$
  - b)  $\frac{2}{5}; (0, 5)$
  - c)  $-\frac{2}{5}; (0, 5)$
  - d)  $\frac{5}{2}; (0, -5)$
  - e)  $-\frac{5}{2}; (0, 5)$
  
3. Simplify  $-7 - 2[-3 - (4 + x) - 2]$ 
  - a)  $9x + 81$
  - b)  $-9x + 81$
  - c)  $2x + 13$
  - d)  $2x + 11$
  - e)  $2x + 25$
  
4. Solve the system of equations:  
 $4x - 5y + 13 = 0$   
 $2x + y = -3$ 
  - a)  $(-2, 1)$
  - b)  $(2, -1)$
  - c)  $(-2, -1)$
  - d)  $(2, 1)$
  - e)  $(2, -5)$

5. Divide:  $\frac{9x^2 - 3x - 2}{3x - 2}$

- a)  $3x - 2$
- b)  $3x + 2$
- c)  $3x + 1$
- d)  $9x^2 + 1$
- e)  $9x^2$

6. Simplify:  $\frac{x^2 + x - 20}{2x + 10} \div \frac{x^2 - 6x + 8}{x^2 + x - 6}$

- a)  $\frac{x + 3}{2}$
- b) 6
- c)  $\frac{1}{2(x + 3)}$
- d)  $\frac{x - 4}{x - 2}$
- e)  $\frac{x + 3}{x - 2}$

7. At Burger Mart, two cheeseburgers and three orders of fries cost \$5.20, while one cheeseburger and two orders of fries cost \$3.05. What would be the cost of five cheeseburgers and four orders of fries?

- a) \$8.25
- b) \$10.40
- c) \$6.10
- d) \$11.30
- e) \$9.85

8. Evaluate  $2x^2 - 3xy^3$  for  $x = -2$  and  $y = -1$

- a) -2
- b) 14
- c) 2
- d) -14
- e) 5

9. Simplify the expression  $-\frac{1}{3}(12x^2 - 9x - 3)$
- a)  $-x + 1$
  - b)  $4x^2 - 3x - 1$
  - c)  $x - 1$
  - d)  $-36x^2 + 27x + 9$
  - e)  $-4x^2 + 3x + 1$
10. Solve the equation  $9x - 6 + 5x - 3 = 4$
- a)  $\frac{1}{14}$
  - b)  $\frac{13}{14}$
  - c)  $-\frac{13}{14}$
  - d)  $\frac{13}{4}$
  - e)  $-\frac{1}{14}$
11. Find the value of  $x^4 + 3x^2 + 7x$  at  $x = 2$ .
- a) 42
  - b) 10
  - c) 18
  - d) 14
  - e) 34
12. Factor  $12x^2 - 14x - 6$  completely.
- a)  $(6x + 2)(2x - 3)$
  - b)  $(3x - 1)(4x + 6)$
  - c)  $2(3x + 1)((2x - 3)$
  - d)  $2(3x - 1)(2x + 3)$
  - e) Prime
13. Write an equation for the line through the point  $(-2, 3)$  that is perpendicular to the line with equation  $2x - 3y = 9$ .
- a)  $2x - 3y = -13$
  - b)  $3x + 2y = 0$
  - c)  $3x + 2y = 12$
  - d)  $3x - 2y = -12$
  - e)  $-2x + 3y = 9$

14.  $\frac{x^2-16}{x^2+x-12} \div \frac{x^2-6x+8}{x^2-5x+6}$

a)  $\frac{x^2-16}{x^2-9}$

b) 1

c)  $\frac{x^2-8x+16}{x^2-6x+9}$

d) -1

e)  $\frac{x-4}{x-3}$

15. For  $x \geq 0$ ,  $\sqrt[3]{x^2} \cdot \sqrt[2]{x} =$

a)  $\sqrt[5]{x^3}$

b)  $\sqrt[6]{x}$

c)  $x\sqrt[6]{x}$

d)  $\sqrt[2]{x^6}$

e)  $\sqrt[5]{x^2}$

16. Write an equation for the following: Ten less than the square of x is equal to the square of the sum of twice x and 4.

a)  $\sqrt{x} - 10 = \sqrt{2x+4}$

b)  $x^2 - 10 = (2x+4)^2$

c)  $(x-10)^2 = 2x^2 + 4$

d)  $10 - x^2 = 2(x+4)^2$

e)  $x^2 - 10 = \sqrt{2x+4}$

17. Simplify:  $\sqrt[4]{162x^9y^7}$

a)  $81x^2y \sqrt[4]{2x^7y^6}$

b)  $3x^2y \sqrt[4]{2xy^3}$

c)  $40xy \sqrt[4]{2x^2y^3}$

d)  $3x^2y \sqrt[4]{3x^7y^3}$

e)  $40x^2y \sqrt{2xy^3}$

18. A motorcycle traveling at 50 miles per hour overtakes a car traveling at 30 miles per hour that had a three hour head start. How far from the starting point are the two vehicles?
- a)  $4\frac{1}{2}$  miles
  - b)  $7\frac{1}{2}$  miles
  - c) 225 miles
  - d)  $56\frac{1}{4}$  miles
  - e)  $26\frac{2}{3}$
19. Solve  $\frac{x^2}{3} = \frac{x}{4} + \frac{7}{12}$
- a) 1 and  $-\frac{7}{4}$
  - b) -1 and  $\frac{7}{4}$
  - c)  $\frac{3 \pm \sqrt{103}}{8}$
  - d) 1
  - e) no real solutions
20. Simplify:  $(2\sqrt{6} - 3\sqrt{2})(4\sqrt{6} + 3\sqrt{2})$
- a)  $30 - 36\sqrt{2}$
  - b)  $36\sqrt{3}$
  - c)  $30 - 12\sqrt{3}$
  - d) 30
  - e)  $18\sqrt{3}$
21. The relationship between the years a car is owned and the book value of the car is linear. If a new car is worth \$22,000 at purchase and only \$10,000 in three years, what would the car be worth in five years?
- a) \$15,333
  - b) \$10,000
  - c) \$2,000
  - d) \$20,000
  - e) \$0

22. If  $x < 0$  and  $y < 0$ , which of the following will always be less than 0?
- a)  $2x + y$
  - b)  $-5xy^2$
  - c)  $y - x$
  - d)  $\frac{x^3}{y^5}$
  - e)  $(x + y)^2$
23. If  $x - 2$  is an odd integer, then which of the following is an even integer?
- a)  $x + 6$
  - b)  $x^2$
  - c)  $4x + 3$
  - d)  $x + 1$
  - e)  $3x$
24. What is the solution set of  $|7 - 2x| > 5$ ?
- a)  $(-\infty, 1)$
  - b)  $(1, 6)$
  - c)  $(-\infty, -1) \cup (-1, \infty)$
  - d)  $(-\infty, 1) \cup (6, \infty)$
  - e)  $(-6, -1)$
25. The width of a rectangular field is half its length. The area of the field is 1800 square meters. What is the length of the field in meters?
- a) 60
  - b) 180
  - c) 600
  - d) 30
  - e) 20
26. The equation  $\sqrt{a+b} = \sqrt{a} + \sqrt{b}$  is true whenever:
- a)  $a = \frac{1}{b}$
  - b)  $ab = 0$
  - c)  $a$  and  $b$  are positive real numbers
  - d)  $a = b$
  - e)  $a + b = 0$

27. Solve for  $x$ :  $\sqrt{2x+3} + 4 = 6$

a)  $x = \frac{1}{2}$

b)  $x = -\frac{1}{2}$

c)  $x = \frac{17}{2}$

d)  $x = -\frac{7}{4}$

e)  $x = \frac{3}{2}$

28. Johnsonville is 70 miles due north of Park City. Georgetown is 90 miles due west of Johnsonville. How far is Park City from Georgetown in miles?

a)  $\sqrt{6300}$

b)  $\sqrt{4900}$

c)  $\sqrt{25600}$

d)  $\sqrt{8100}$

e)  $\sqrt{13000}$

29. An accountant received a 5% raise over her previous year's salary plus a one-time bonus of \$2000. If her income for the new year, including the bonus, is \$56,075, then what was her salary during the previous year?

a) \$54,075

b) \$51,271

c) \$51,371

d) \$51,500

e) \$51,405

30. Simplify completely.  $\frac{1-x^{-1}}{1-x^{-2}} =$  ( $x \neq 0, 1, -1$ )

a)  $x$

b)  $\frac{x}{x+1}$

c)  $\frac{1}{x}$

d)  $1 + \frac{1}{x}$

e)  $1+x$



31. Is the function  $f(t) = 6t^5 + 4t^3 + 2t$

- a) symmetric about the y-axis
- b) symmetric about the origin
- c) a parabola
- d) symmetric about the x-axis
- e) symmetric about the line  $y = x$

32. Let  $f(t) = 2t^2 - 3t + 5$ . Find  $f(t-1)$ .

- a)  $2t^2 - 7t + 6$
- b)  $4t^2 - 11t + 12$
- c)  $2t^2 - 7t + 10$
- d)  $2t^3 - 5t^2 + 8t - 5$
- e)  $2t^2 - 3t + 4$

33. Solve the inequality:  $|2 - 3x| \leq 8$

- a)  $x \geq -2$
- b)  $x \leq -2$  and  $x \geq \frac{10}{3}$
- c)  $-2 \leq x \leq \frac{10}{3}$
- d)  $x \leq -2$
- e)  $x \geq \frac{10}{3}$

34. Which of the following polynomials has zeros of -2, 3, and 4?

- a)  $x^3 + 5x^2 - 2x - 24$
- b)  $x^3 - 5x^2 - 2x + 24$
- c)  $x^3 - 9x^2 + 26x - 24$
- d)  $x^3 + 9x^2 - 26x + 24$
- e)  $x^3 - 2x^2 + 3x + 4$

35. Perform the indicated operations and simplify.  $\frac{3x-3}{x} \cdot \frac{3x^2}{4x-4}$

a)  $\frac{9x^3 - 9x^2}{4x^2 - 4x}$

b)  $\frac{9x}{4}$

c)  $\frac{4}{9x}$

d)  $\frac{9x^2 - 9x}{4x - 4}$

e)  $\frac{4x^2 + 8x + 4}{x^2}$

36. Divide and Simplify  $\frac{15x^6 - 40x^5 + 20x^4}{10x^5}$

a)  $5x - 50 + \frac{10}{x}$

b)  $\frac{3x}{2} - 4 + \frac{2}{x}$

c)  $\frac{7x}{2} - 4$

d)  $\frac{3x-2}{2x}$

e)  $\frac{3x}{2} - 4 + 2x$

37. Simplify  $\frac{25^{1/4}}{25^{3/4}}$ .

a) 1

b) 25

c) 5

d)  $\frac{1}{5}$

e)  $\frac{1}{25}$

38. Four times the difference of a number and one is equal to six times the sum of the number and three. Find the number.
- a) -7
  - b) 11
  - c) -2
  - d) -11
  - e) 7
39. Simplify the expression  $-5\sqrt{50} + 5\sqrt{162} - 4\sqrt{8}$
- a)  $12\sqrt{2}$
  - b)  $-4\sqrt{220}$
  - c)  $6\sqrt{2}$
  - d)  $-5\sqrt{2}$
  - e)  $-8\sqrt{55}$
40. Which one of the following is true?
- a) Neither  $(-8)^{1/2}$  nor  $(-8)^{1/3}$  represent real numbers
  - b)  $\sqrt{x^2 + y^2} = x + y$
  - c)  $(-8)^{-1/3} = -2$
  - d)  $2^{1/2} \cdot 2^{1/2} = 2$
  - e) none of these